

# The AMSAT<sup>®</sup> Journal

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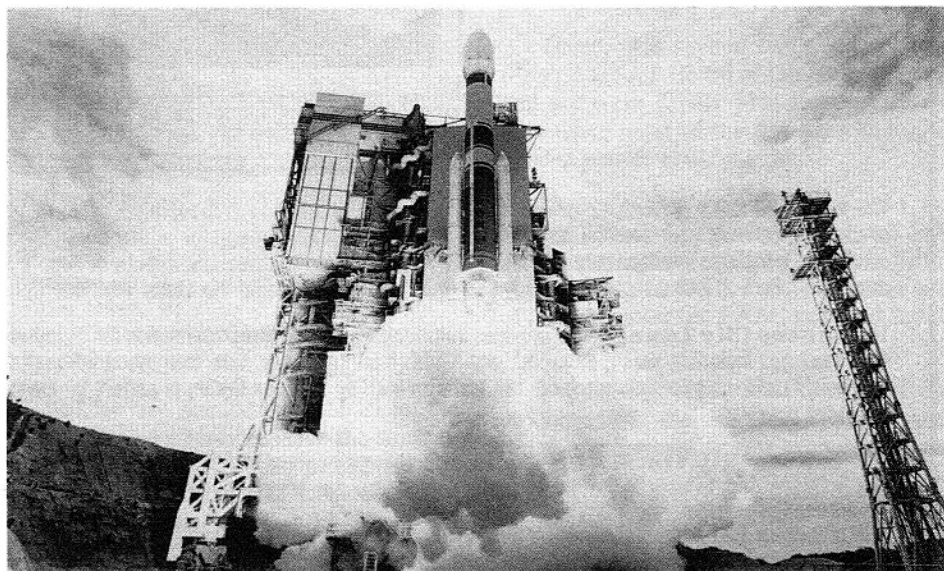
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September/October 1996

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**Liftoff! The successful launch of JAS-2 and ADEOS satellites from Tanegashima Space Center, Japan at 0153 UTC on August 17, 1996. (NASDA photo)**

## JAS-2 Comes to Life as FO-29

**Fujio Yamashita, JS1UKR and Hideo Ono, JA1BU  
JARL Technical Laboratory**

*Editor's Note: Many thanks to Fujio Yamashita, JS1UKR and Hideo Ono, JA1BU for quickly providing first-hand accounts of the JAS-2 (recently named FO-29) launch. The following is not a technical description, rather a summary of what they saw, did, and felt during the first exciting days of FO-29. Data analysis, operation schedules, and other news will follow via ANS Bulletins and The AMSAT Journal.*

**Launch Site, Tanegashima Space Center, Japan by Hideo Ono, JA1BU**

On early morning, August 17, 1996, final launch operations were commenced by The National Space Development Agency of Japan (NASDA) at Tanegashima Space Center (TNSC) on Tanegashima Island on the southern end of Kyushu. A huge white rocket stood ready next to the side of large service building, both facing a cobalt

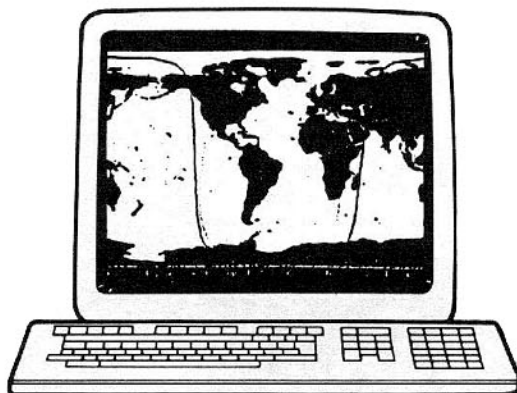
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# Apogee View

by Bill Tynan W3XO

## A Busy Time

The past few months have been particularly busy for those of us you have entrusted with guiding your organization.

First and foremost, there has been much going on with respect to Phase 3D. The Ariane 501 failure and its aftermath have kept several of us very occupied. In particular, Keith Baker and Dick Jansson journeyed to Europe to meet with Phase 3D Project Leader Karl Meinzer and some of his folks to map strategy before attending meetings with ESA officials in Paris. While there, they took time to attend a kick-off that Karl had scheduled for the P5 Mars Project.

In May, we learned from ARRL of the proposal to take away or share the amateur 2-meter and 70-cm bands to provide for so-called *Little LEO* data relay satellites. We were convinced that this threat required a swift and strong response from AMSAT.

Also in May, we learned that IARU had formed a committee called *Future of Amateur Service Committee* (FASC). This committee was formed to address several questions related to possible changes to the international Amateur Service and Amateur Satellite Service rules at the 1999 World Radio communications Conference

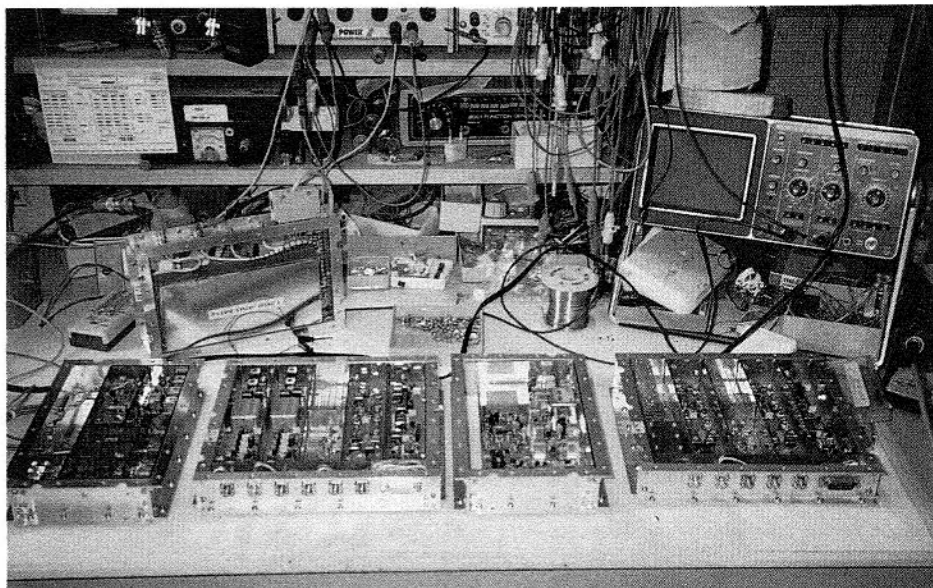
(WRC), the new name for WARC's. We were asked to make recommendations pertaining to the amateur satellite service.

In addition, a proposal was made to seek a change in the allocations to provide for *Synthetic Aperture Radar* (SARs) in the 70-cm band at about 435 MHz. ARRL asked us to help them with that one.

These, plus several other issues called for an AMSAT Board of Directors meeting and we were finally able to coordinate a date when most of the directors and other needed people could attend.

Unfortunately all directors were not able to attend. The date selected was June 29th and the place was our office in Silver Spring, Maryland. This was just in the nick of time because the FASC required inputs by the end of June.

I won't go into any details of the outcome of the meeting, our FASC recommendations or our response to the Little LEO or SAR proposals, because the Board minutes are contained in this issue of the Journal as are our Little LEO letter, FASC recommendations and a brief report to the Mars Mission meeting. The SAR situation and other items are covered in the Board minutes. I urge all members to read these documents. Only by doing so, can an understanding of the wide range of subjects and problems with which AMSAT must deal, be understood and appreciated. ■



Flight electronic modules for the Phase 3D International Satellite undergo final bench testing at the AMSAT-DL Laboratory in Marburg, Germany prior to their shipment to Orlando, Florida for integration into the satellite. (AMSAT-NA photo by Keith Baker, KB1SF)



[FO-29, Continued from Page 1] blue subtropical ocean and warm summer weather. The weather in the area of the launch was excellent with a slight breeze. There were no traces of the heavy typhoon, one of twelve for the season, that had attacked Tanegashima only three days earlier. I was watching the launch pad from three kilometers away in the Range Control Center where I was representing JAS-2 for JARL. The H-II-B No. 4 (B is the latest second stage vehicle which is equipped with a LOX/LH2 engine) that was autonomously developed using Japanese technology. It is Japan's most powerful launch vehicle, capable of delivering a 2-ton class satellite into geostationary orbit or a 10-ton satellite into low Earth orbit. This is also the fourth H-II launch following the Orbital Re-entry Vehicle and Vehicle Evaluating Payload in February 1994, Engineering Test Satellite in August 1994, and the Space Flyer Unit and Geostationary Meteorological Satellite-5 in March 1995.

The two payloads on the H-II-B No. 4 are the Advanced Earth Observing Satellite (ADEOS) and Japan Amateur Satellite 2 (JAS-2). ADEOS is the largest satellite Japan has ever developed with 3.5 tons of mass and 4-meters in diameter and width and 11-meters in height. ADEOS also has a 3- by 24-meter solar panel that powers eight sensor modules developed by NASDA, Environment Agency, Ministry of International Trade and Industry, NASA, and CNES. JAS-2 is a piggyback payload and is mounted on the Payload Attachment Fitting at the top of LOX tank of the H-II/4-B second stage.

At 0935 Japan Standard Time (JST) (0035 UTC) when the final countdown started, I went on the top floor of the Range Control Center

building with ADEOS visitors from various foreign countries. Status reports were announced by a NASDA officer through an intercom loudspeaker. At 1053 JST (0153 UTC), the launch vehicle lifted off smoothly with a bright orange flame from the main engine and a big white stream of smoke from the two solid rocket boosters. Rapidly the vehicle extended high up in the sky like a rising dragon into the heavens. To my regret, launch visibility was not very good due to slight clouds which covered my field of view. Also, the rocket flew between my line of sight and the Sun so I could not follow it for long periods.

After the launch, I returned to the Range Control Center to continue listening to the launch announcements. Main engine burnout occurred at 1059 JST, and status was normal. At 1103 JST the second engine was reporting normal and everyone cheered when *ADEOS Separation* was announced at 11:09 JST.

#### JARL Control Station, Tokyo Japan by Fujio Yamashita, JS1UKR

Satellite Control Team members and other interested persons gathered early in the morning on launch day at the JARL Control Station at Sugamo, Tokyo. Equipment was checked again and again in anticipation of launch. Hideo was at the TNSC relaying launch information to our team.

The countdown started at 0935 JST and at 1053 JST sharp, the H-II-B No.4 lifted off flawlessly. (*Editor's Note: See the July/August 1996 issue of The AMSAT Journal for the flight sequence.*) Telemetry data from the launch were acquired by the NASDA station at Showa Base, Antarctica by the Japanese Antarctic Research Expedition. Amateur Radio operators at station 8J1RL located at Showa Base successfully received the JAS-2 beacon signals during

separation and startup. They were probably the first to receive the JAS-2 beacon signal. The information of a successful JAS-2 separation was reported from Showa Base to TNSC via an INMARSAT link. Everyone at the JARL Control Station cheered when TNSC relayed the report that beacon signal reception of JAS-2 was received at Showa Base, Antarctica.

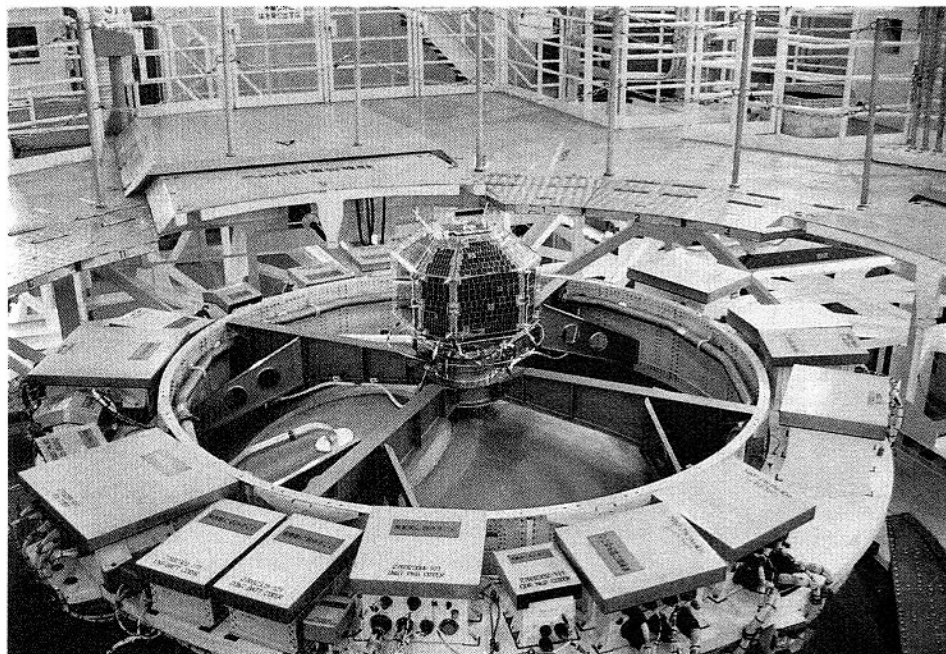
Then, after nervously waiting one hour for AOS in Tokyo of JAS-2, the clear signal *HI...HI..HI* came out from the speaker. Yes, it was from JAS-2! Applause spontaneously occurred, and immediately afterwards, we started recording JAS-2's Morse code telemetry. Letter by letter, we filled paper with two-digit telemetry. These data were immediately analyzed....bus voltage is okay; solar cell current enough; storage battery temperature moderate, and so on. Telemetry data showed that the health of JAS-2 seemed good. After this pass, JAS-2 would be out of sight from Tokyo for about six hours.

That evening, we received AOS at 2056 JST and various commands were sent to JAS-2. These commands were also repeated during next pass at 2241 JST. During these passes JAS-2 had been in mode JA with beacon telemetry. Using JAS-2's beacon signal, we also observed the Doppler shift of its frequency which was used to check its orbit. A comparison of JAS-2's first orbit prediction was made using the rocket flight plan and our observed Doppler shift curve. It showed a fairly good fit with the estimated shift and after several passes we had confidence that these observations were good enough to use as orbital elements. Later, we would find these Keplerian elements were not so different from the two-lines first announced by NASA on August 21.

On August 18, during the evening pass that began at 2146 JST, JAS-2's digital transponder was turned on for the first time. A familiar 1200 bps packet tone came to life after being activated. As a test we wrote and copied the first message.

JAS-2's attitude control will start once the transponder checkout is completed. It will take a longer time to build up proper attitude and to get JAS-2 spinning. As a result, the transponder will occasionally be turned on and off without notice until we get the satellite in stationary condition. Also, some software related problems have occurred in the system which must be dealt with before normal operation. Therefore the schedule may be delayed. Full operation of JAS-2 will be announced when it is ready.

*Editor's Note: When submitting this article, Fujio informed us he will be retiring from his position as Director of the JARL Technical Laboratory at the end of September. Hideo Ono, JA1BU will succeed Fujio in this position. We wish Fujio the best of luck in retirement and thank him for his efforts in keeping us continually informed on the JARL satellite program. We hope to continue hearing him on the birds. ■*



JAS-2 mounted on the top of the second stage fuel tank of the H-II-B. (JARL photo)



# The Amateur Satellite Service in 1996

Ray Soifer, W2RS, Vice President - International Affairs

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*Editor's Note: The following paper was originally presented at the Eleventh AMSAT-UK Colloquium, held at the University of Surrey, England, July 25-28, 1996.*

My original intention was to prepare a paper on the future of the Amateur Satellite Service, as a contribution to the IARU planning process for WRC-99. However, when I sat down to begin my outline, it quickly became apparent that we have very little information about the actual usage and participation patterns in our service today, e.g.:

- How many amateurs are involved with amateur satellites?
- Where are they located?
- How many have operational stations, and how active are they?
- Which satellites and modes do they use?
- Are they members of AMSAT organizations?

It cannot be overemphasized that the primary justification for the retention and expansion of Amateur Satellite Service frequencies is our continuing contribution to technology, not our numbers. However, without knowing where one is, it is very hard to figure out where one should be going. So, I determined to come up with the best information I could about the actual state of the Amateur Satellite Service in 1996.

As it happens, AMSAT-NA had asked Steve Grant, N8AJD, to conduct a mail survey of our membership in mid-1995. After working with Keith Baker, KB1SF, to formulate the questions, Steve sent out questionnaires to approximately 10% of the members, selected at random, and received responses from about 30% of those surveyed. It would not have been practical to ask every AMSAT organization in the world to do the same thing; besides, I was somewhat concerned that the self-selection inherent in a mail questionnaire (what about the 70% who did not choose to return it?) might have biased the results in some unpredictable way.

So, I developed my own questionnaire and sent it to each of the 23 AMSAT groups (now 24) which subscribe to *AMSAT-International@amsat.org*, the Internet distribution list for AMSAT organizations worldwide. Including AMSAT-NA, for which Keith and I adapted the results of Steve's survey to the present circumstances, eleven AMSAT organizations responded, which eleven are believed to account for more than two-thirds of the AMSAT members and active amateurs in our service today.

This AMSAT-International questionnaire, a copy of which is appended, was addressed to the leaders of each AMSAT organization and asked not for a scientific survey of their membership — as difficult and expensive as that might have been — but rather for the leaders' own educated guesses about Amateur

Satellite Service activity in their respective countries. Armed with the survey data from those responding, I then made my own less-educated guesses to fill in the blanks of non-responding organizations and parts of the world with no AMSAT organizations at all.

What we have here, then, is not a collection of hard, irrefutable data but simply a series of educated guesses by those in the best position to know about Amateur Satellite Service conditions in their own countries and regions. Until something better comes along, however, I am convinced that it is reasonably accurate, at least to within an order of magnitude, and certainly provides better data than we had before.

The results of these educated guesses are presented in Tables 1-5, which you are invited to study at your convenience and to form your own conclusions. However, I have already formed a few conclusions of my own, to wit:

- More than 18,000 amateurs currently participate in the Amateur Satellite Service in one way or another. Of these, nearly half operate on the birds at least once a month, and about 16,000 belong to an AMSAT organization.
- These figures are more impressive than they may seem at first glance. For example, DXCC is the most popular operating awards program in amateur radio and it had 7,670 active participants in the year ending September 30, 1995. About 3,000 amateurs enter the ARRL DX Contest annually.
- According to ARRL data, for every US amateur presently active on one or more satellites (about 3,000), there are at least five more who have been on the birds at some time in the past and are no longer. If this ratio is representative of the world at large, there may be as many as 40,000 to 50,000 amateurs who have gained at least some experience with OSCAR satellites since 1972. This is again comparable to DXCC, which has issued some 75,000 certificates since 1945, which figure includes multiple certificates to the same individuals, e.g., five to me alone (Mixed, Phone, CW, Satellite and 5BDXCC). About two-thirds of these 40,000-50,000 would be former AMSAT members or may never have been AMSAT members.
- Activity in the Amateur Satellite Service, then, appears reasonably comparable to those of other facets of amateur radio which require similar levels of commitment on the part of the amateur. It should not be compared, for example, to FM repeaters, local packet radio or HF ragchewing, for which the required levels of technical knowledge and station equipment are significantly lower than for satellite operation, HF DXing or contesting.

- Within our service, about 25% of those with stations have equipped themselves to use digital spacecraft. Earth stations for 9600-baud spacecraft outnumber those with 1200-baud equipment by approximately 2.6:1. However, it must be borne in mind that 75% of present Amateur-Satellite Service earth stations are equipped for analog modes only. Apart from Phase 3D, comparatively little of today's satellite construction activity is going into serving their needs.
- Mode B (70cm up and 2m down) is by far the most popular analog mode with a 60% share of AMSAT members' stations. This is followed by Mode A (2m up and 10m down) with 40% and Mode K (15m up and 10m down) with 20%. The evident continuing popularity among users of Modes A and K is also well worth noting by prospective satellite builders.
- Of AMSAT members with satellite stations, only about 3% are currently equipped for Mode S (70cm up and 13cm down). Another way of looking at this is that of those already equipped for Mode B, i.e. with transmitters and antennas for the 70cm uplink, about 95% have not set up the 13cm receiving facilities which would put them on Mode S. With the imminent demise of AO-13, whatever growth in Mode S activity we are likely to see will have to await the actuality of Phase 3D.
- Virtually every AMSAT member with a working station is equipped to communicate with manned space vehicles, i.e. MIR and SAREX, due to their comparatively simple earth station requirements. The effect of this may be observed frequently during missions.

Regional differences in activity are about what one might have expected, with about 90% concentrated in the Northern Hemisphere and another 90% in Regions 1 and 2. However, users in the Southern Hemisphere and in Region 3 appear to be more technically advanced, on average, than those in other parts of the world, judging by their greater proportional representation on the digital satellites and on Mode S.

AMSAT organizations report that approximately 3% of their members do not engage in satellite operation at all but are involved exclusively in technical pursuits such as satellite design,

construction and software development. This undoubtedly understates the total number of *techies* among us, since some of them operate as well. Or do they?

Another 3% of AMSAT members are said to listen and/or copy telemetry rather than operating through the satellites themselves. I am only reporting the numbers I have, but where are these people when the command stations need telemetry data?

Although not included in my AMSAT-International survey, N8AJD asked AMSAT-NA members two specific questions about their preferences for future satellite projects and their potential willingness to support them financially. These questions, and the responses received, are presented in Tables 6 and 7, respectively.

From these responses, it is reasonable to conclude that both types of orbits presently utilized by amateur radio satellites — Phase 3 and LEO — still represent desirable alternatives for future programs, although the Phase 3-type orbit is preferred by a 2:1 margin and were a suitable opportunity were to come along for a geosynchronous orbit, AMSAT-NA members would be favorably disposed toward such an effort.

As to the type of payload desired, linear (analog) transponders are still far-and-away the most popular choice. However, among those members who asked for digital spacecraft, there was a strong preference for 9600 baud over 1200 baud; many digisat users asked for even faster data rates and the consequently wider bandwidths. Parenthetically, one cannot help wondering whether all the members who asked for faster data rates than 9600 baud fully realize that the earth stations for such satellites would have to be more complex and expensive than are present stations, since in all probability they would require microwave uplinks, spread spectrum or both.

If the answers to Steve's financial support query are extrapolated to AMSAT-NA's membership as a whole, taking into account the 30% response rate to his original questionnaire, our members told us that they, collectively, would be willing to pledge about \$100,000 annually for satellite development, construction and launch efforts. Bear in mind, however, that each respondent assumed that the satellites that would be built are the ones he or she wanted! It is a given, of course, that nobody can please all of the people all of the time. On the other hand, our intensive fundraising

**Table 1**  
**AMSAT Membership by ITU Regions and Hemispheres**

|          | AMSAT<br>Members | Active<br>Nonmembers | Total  |
|----------|------------------|----------------------|--------|
| Region 1 | 6,200            | 1,400                | 7,600  |
| Region 2 | 7,900            | 1,000                | 8,900  |
| Region 3 | 1,900            | 100                  | 2,000  |
| Total    | 16,000           | 2,500                | 18,500 |
| North    | 14,700           | 2,400                | 17,100 |
| South    | 1,300            | 100                  | 1,400  |

**Table 2. Activity Patterns of AMSAT Members by ITU Regions and Hemispheres**

|          | Have<br>Operated | Currently<br>Active | Not Active<br>but<br>Satellite-<br>Capable | Listen<br>Only | Total<br>Members |
|----------|------------------|---------------------|--------------------------------------------|----------------|------------------|
| Region 1 | 3,700            | 1,800               | 1,900                                      | 200            | 6,200            |
| Region 2 | 6,100            | 3,100               | 3,000                                      | 100            | 7,900            |
| Region 3 | 1,500            | 700                 | 800                                        | 250            | 1,900            |
| Total    | 11,300           | 5,600               | 5,700                                      | 550            | 16,000           |
| North    | 10,300           | 5,200               | 5,100                                      | 400            | 14,700           |
| South    | 1,000            | 400                 | 600                                        | 150            | 1,300            |

**Table 3. Amateur-Satellite Service Usage AMSAT Members and Active Nonmembers by ITU Regions and Hemispheres**

|          | Active<br>Users | Other<br>Satellite-<br>Capable<br>Members | Member<br>Listeners | Total  |
|----------|-----------------|-------------------------------------------|---------------------|--------|
| Region 1 | 3,200           | 1,900                                     | 200                 | 5,300  |
| Region 2 | 4,100           | 3,000                                     | 150                 | 7,250  |
| Region 3 | 800             | 800                                       | 100                 | 1,700  |
| Total    | 8,100           | 5,700                                     | 450                 | 14,250 |
| North    | 7,600           | 5,100                                     | 350                 | 13,050 |
| South    | 500             | 600                                       | 100                 | 1,200  |

effort on behalf of Phase 3D has done somewhat better than the \$100,000 annual figure indicated here, so this response should be taken as indicating an order of magnitude rather than as hard data.

Then, too, this order-of-magnitude figure includes only direct financial support from AMSAT-NA members. It does not include members of other AMSAT organizations, support from IARU societies such as ARRL, funding from non-amateur radio sources or contributions in forms other than cash.

It must also be noted that the AMSAT-NA membership survey upon which Tables 6 and 7 are based, by definition, surveyed only present members of AMSAT-NA, not potential or prospective members. Whenever we ask them (e.g., at convention forums, radio club talks, etc.), most of these non-members say that they would prefer satellites that are simpler, easier and less expensive to use (ideally, with the equipment that such amateurs already own for terrestrial applications) than the members' responses in Table 6, and the present activity patterns in Table 4, would suggest. Were potential members included in the survey, Modes K and A, analog FM on Modes B and/or J, geosynchronous orbits and 1200-baud FSK packet radio all would have ranked higher in the charts.

So there we have it: the composition of the Amateur Satellite Service in 1996. Now that we have figured out where we are, give or take a reasonable degree of measurement error, we are ready to begin thinking about where we should be going. May all of your thoughts be productive!

**Table 5  
AMSAT Members Who Don't Operate**

|          | Design,<br>Construction<br>& Software | Listen<br>but Don't<br>Transmit | No Activity<br>At All. Ever |
|----------|---------------------------------------|---------------------------------|-----------------------------|
| Region 1 | 200                                   | 200                             | 2,100                       |
| Region 2 | 150                                   | 100                             | 1,550                       |
| Region 3 | 100                                   | 250                             | 50                          |
| North    | 350                                   | 400                             | 3,650                       |
| South    | 100                                   | 150                             | 50                          |
| Total    | 450                                   | 550                             | 3,700                       |

**Table 4  
Present Capabilities of AMSAT Members' Stations**

|                                | Region 1 | Region 2 | Region 3 | North  | South | Total  |
|--------------------------------|----------|----------|----------|--------|-------|--------|
| <b>LEO Analog Satellites:</b>  |          |          |          |        |       |        |
| Mode A                         | 1,700    | 1,900    | 800      | 3,600  | 800   | 4,400  |
| Mode B                         | 1,100    | 3,900    | 800      | 5,000  | 800   | 5,800  |
| Mode J                         | 1,000    | 400      | 900      | 1,500  | 800   | 2,300  |
| Mode K                         | 1,100    | 1,100    | 200      | 2,200  | 200   | 2,400  |
| Mode T                         | 900      | 1,100    | 100      | 1,900  | 200   | 2,100  |
| <b>LEO Digital Satellites:</b> |          |          |          |        |       |        |
| 1200 Baud                      | 300      | 500      | 200      | 900    | 100   | 1,000  |
| 9600 Baud                      | 800      | 1,500    | 300      | 2,400  | 200   | 2,600  |
| <b>AO-10/AO-13:</b>            |          |          |          |        |       |        |
| Mode B                         | 2,200    | 3,800    | 600      | 6,000  | 600   | 6,600  |
| Mode S                         | 100      | 100      | 100      | 250    | 50    | 300    |
| <b>MIR/SAREX:</b>              |          |          |          |        |       |        |
|                                | 4,100    | 6,100    | 1,100    | 10,400 | 900   | 11,300 |

#### Appendix

*The following was sent to AMSAT-International Subscriber Organizations:*

For a paper I am writing (hopefully to be presented at Surrey and submitted to IARU), I would very much appreciate your answers to the following questions about Amateur-Satellite Service usage in your country. Your answers will not be published individually, nor will individual-country data be listed in any way. Rather, all I am trying to develop are rough, aggregate figures for the world in general and, data permitting, for each ITU Region.

For my purposes, the timeliness of your response is more important than its precise accuracy. I'd rather have your rough

**Table 6  
What types of satellites would you like AMSAT-NA to construct and launch in the future? Rate your desires on the scale of 4 (most) to 0 (not at all).**

| Type                | Percent |
|---------------------|---------|
| Phase 3D-Type Orbit | 54      |
| Geosynchronous      | 51      |
| Low Earth Orbit     | 26      |
| Analog SSB/CW       | 60      |
| 9600B FSK           | 29      |
| Analog FM           | 26      |
| Wider-Band          | 25      |
| Higher Speed FSK    | 23      |
| 1200B FSK           | 10      |

*Figures add to more than 100% because of the multiple weighted responses requested. The percentages in this table do not represent the percentage of members desiring any particular alternative, but only the total points scored by each divided by the number of responses received.*



*educated guesses* within a day or two than to have you do a lot of work and respond to me three weeks from now. Your guesses will be better than mine, and given the inherent uncertainties of the subject matter, any increased accuracy really wouldn't be worth the added effort on your part.

If you don't believe yourself to be capable even of guessing the answers to some of the questions below, please feel free to answer only what you can.

Ready? Here goes...

1. Approximately how many members does your AMSAT organization have?

2. Of those, roughly how many have EVER operated through an OSCAR satellite?

3. Of those who have operated, approximately how many would you say presently have stations capable of operating through one or more of the following:

a. LEO analog birds:

Mode A?

Mode B?

Mode J?

Mode K?

Mode T?

b. LEO digital birds:

AO-16/LO-19?

UO-22/KO-23/KO-25?

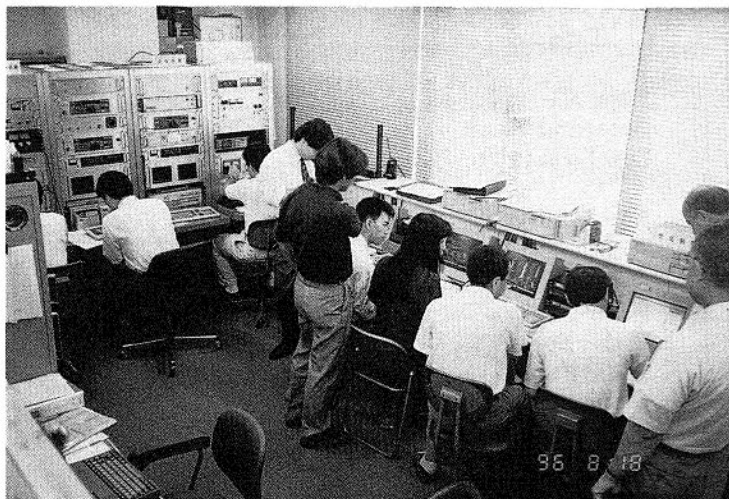
c. AO-10/AO-13:

Mode B?

Mode S?

d. MIR/SAREX?

4. Of those you listed as *satellite-capable*, roughly how many would you say are presently active operators, i.e., use that mode at least once a month?



Data acquisition during one of JAS-2's first passes over the JARL Satellite Control Station, Sugamo, Tokyo, Japan. (JARL photo)

**Table 7. Estimated Annual Donations for Satellites**

| <u>Amount (Dollars)</u> | <u>Percent</u> |
|-------------------------|----------------|
| 0                       | 20             |
| 25                      | 29             |
| 50                      | 27             |
| 100                     | 19             |
| 200                     | 5              |

5. About how many members do you have who are not satellite users themselves (they may not even be licensed) but who:

a. participate personally in AMSAT satellite design, construction and/or software development activities?

b. listen to or capture telemetry, files etc from Amateur Radio satellites (including MIR/SAREX, UO-11, WO-18 and what have you)?

6. Approximately how many *active* satellite users (i.e., at least once a month) do you think there are in your country who are not members of an AMSAT organization? (Remember, we won't be publishing your response!)

Please respond via e-mail to me at [w2rs@amsat.org](mailto:w2rs@amsat.org). Thank you very much for your help.

73, Ray ■

**NOVA for Windows .....\$Call/Special**  
**NEW: WinTrak Pro .....\$Call**  
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**Eggbeaters .....\$Call**  
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**HF Single Band High Performance Vertical**  
**Ground Plane Antennas, 160, 80, 40 M ....\$Call**  
 \*plus shipping \*\*USA prices only. Canada, overseas call for price.

**R. Myers Communications**

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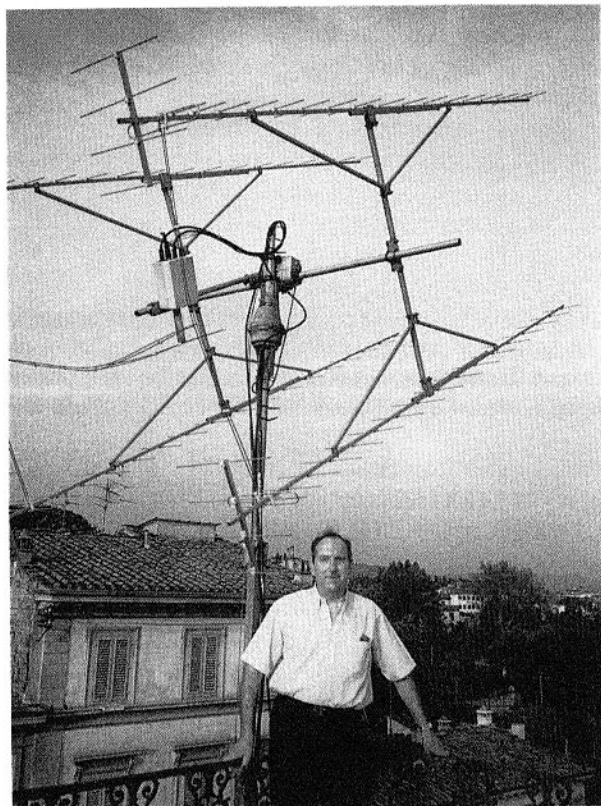
Voice: 602-837-6492 FAX: 602-837-6872 VISA/MC

Email: [bmyers@primenet.com](mailto:bmyers@primenet.com)

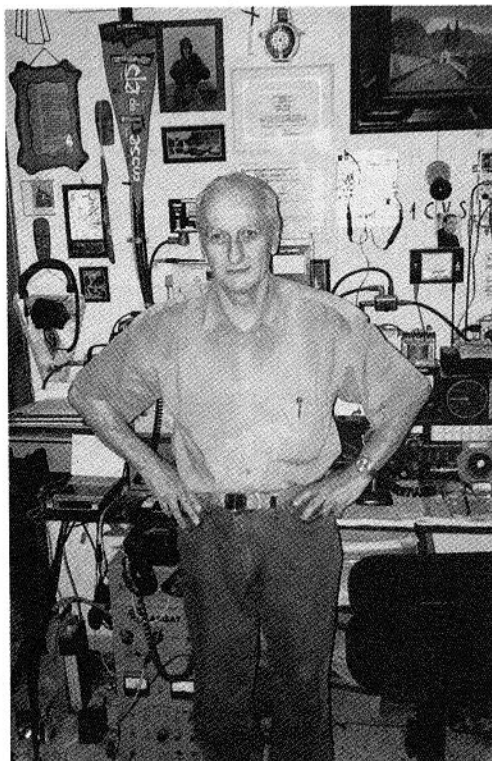
<http://www.primenet.com/~bmyers/>

## AMSAT-Italia Pictorial

This past summer, Perry Klien, W3PK had the opportunity to visit Italy and some of the members of AMSAT-Italia. Many thanks to W3PK for sharing these photos with us. ■



Piero Moroni, I5TDJ in Florence with his OSCAR antennas. (W3PK photo)



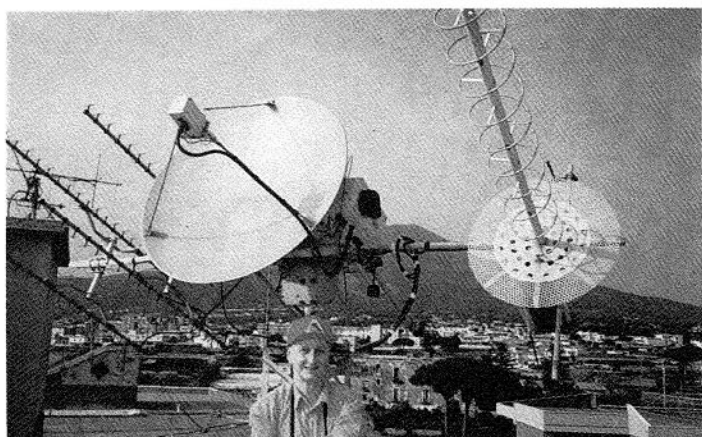
AMSAT-Italia President Emeritus Domenico Marini, I8CVS in Torre Del Greco with his home-brew OSCAR equipment. (W3PK photo)



IO-26 Project Team Members (left to right): Luca Bertagnolio, IK2OVV, Carlo DeBartholomaeis, IW2CTJ, and Dr. Alberto Zagni, I2KBD, IO-26 Mission Director (W3PK photo)



Enrico Masetti, I5TI at his OSCAR work station in Florence. (W3PK photo)



AMSAT-Italia President Emeritus Domenico Marini, I8CVS in Torre Del Greco with his OSCAR antennas. Note Mount Vesuvius volcano in the background. (W3PK photo)

## AMSAT-UK Colloquium Report

Richard W L Limebear, G3RWL  
Communications Officer, AMSAT-UK  
*richard@g3rwl.demon.co.uk*

This year's AMSAT-UK Colloquium at the University of Surrey (UoS) was attended by 92 people; I did not count the countries but a good guess is seventeen countries from five continents (attendees from South America are rare). Although rain was forecast, it stayed away most of the time and had no effect on the event; indeed, most of the time the weather was hot and sunny.

The big news was the fact that Phase 3D is almost certain to fly on Ariane-502 unless we get bounced by a commercial customer; and this is thought unlikely. The flight could happen as early as mid-February 1997 but the official time-line says *in the first half of the year*.

This flight worries several people but if we want a (relatively) inexpensive flight we have to take some chances. Professional opinion is that the AR-502 flight cannot be anything but successful if ESA wishes to retain credibility in the launch business. The Europeans *have* replicated the cause of the AR-501 flight failure in ground simulation. It is rumored that Phase 3D should have been on AR-501 but the Cluster group did not want us on the flight - Thanks fellas.

Wednesdays (UTC) were, historically, *experimenters' day* on the satellites; the meeting agreed that this concept should be re-introduced to facilitate experimentation using new modes and techniques.

What happens to the Shuttle Amateur Radio EXperiment (SAREX) when the US starts to use other space platforms than the Shuttle? Consideration is being given to replacing the word *Shuttle* with *Space*; this would, of course, retain the present acronym SAREX.

IARU Region 1 is starting the process of extending the IARU Monitoring Service to protection of the satellite bands as well as HF. Here in Europe it is a big problem in some countries (e.g. Spanish taxi communications in the 2m band frequently block

satellite uplinks). The point was made that amateurs often just protest, saying *they* should do something about it (where *they* means national organizations); in fact *they* is *us* so any moves need us to initiate and support official actions, this already happens on HF. The problem exists outside Region 1 but the other IARU Regions have not yet made the commitment to support IARU-MS in this area.

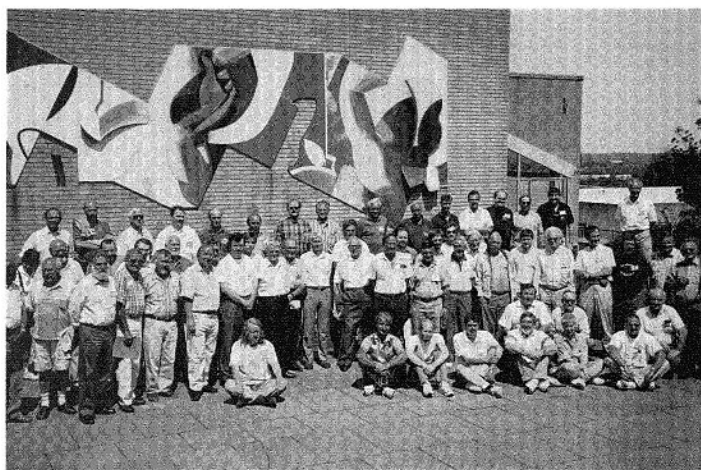
**International Space Station:** Plans for the International Space Station (ISS) include digital/sstv/atv modes as well as the traditional transponder modes (fm/ssb/cw); likely bands are 21/28 MHz (ssb) as well as 145/435/1260 MHz. Probably all operations will use external antennas. The facility will probably exist to *bolt-on* new autonomous modules during a space-walk.

Recommended frequencies for future Mir and ISS operations are: voice - 144.45/47 MHz uplink, 145.81 MHz downlink; packet - 144.49 MHz uplink, 145.81 MHz downlink. A secondary downlink of 145.84 MHz will be used to avoid QRM when space platforms are in close proximity. Any simplex operations will probably use 144.45/47/49 MHz.

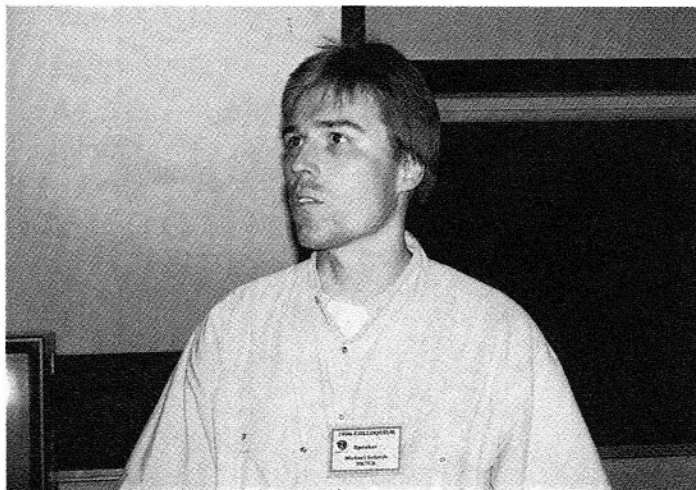
ISS planners are looking for outside expertise and support; if you can help with this please contact Frank Bauer, KA3HDO at his Internet address which is *ka3hdo@amsat.org*.

The present *waiting time* for a school to have a SAREX schedule averages one to two years but requests are examined for merit before allocation.

**Amateur Radio Satellite Operators Survey:** Ray Soifer, W2RS has assembled statistics about amateur radio satellite operators (*Editor's Note: See W2RS' article on page 5 of this issue*). There seem to be about 18,000 satellite operators world-wide; 25% of these have some sort of digital capability, 40% have a mode-A capability (and 3% mode-S). The recent AMSAT-NA questionnaire asked what their members wanted: the Molniya orbit



Group photo showing many of those attending the 1996 AMSAT-UK Colloquium at the University of Surrey, Guildford, England.  
(AMSAT-NA photo by Keith Baker, KB1SF)



Michael Scharfe, DK7UX, discussed the Phase 3D design. (W2RS photo)





**Frank Bauer, KA3HDO is flanked by two key SAREX telebridge station operators, Hans van de Groenendaal, ZS5AKV and Graham Ratcliff, VK5AGR. (AMSAT-NA photo by Keith Baker, KB1SF)**

is most wanted, next geo-synchronous; there is still a fairly high demand for LEO spacecraft.

**TM-Sat:** TM-Sat (Thailand) is being built at UoS; flight on a Zenith booster is expected to be about July 1997; orbit 800 km sun-synchronous. The payload includes store-and-forward communications at 9.6, 38.4 and 76.8 kbps with DSP as well as hardware modems; slow-scan camera; other imaging (to 100 meter resolution, color); GPS.

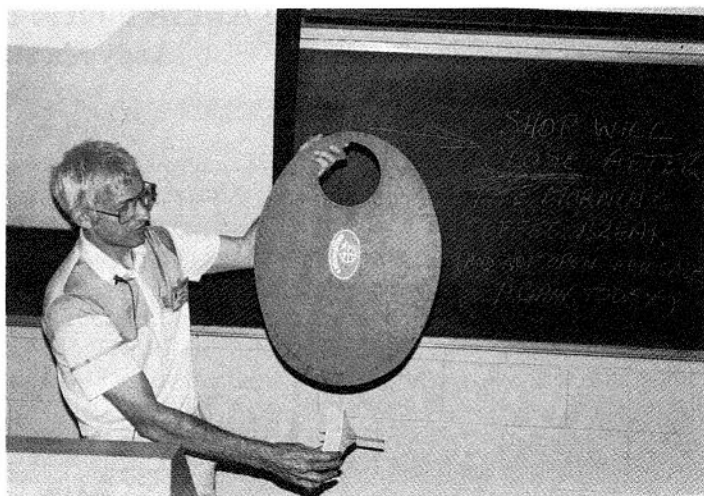
**Merlion:** The UoS 300 Kg mini-sat project is ongoing. Its Merlion payload includes multi-spectral imaging with 40m and 10m resolution; 7W of rf, circularly polarised (quadrifilar) antennas providing a shaped footprint; bit-rates up to 1Mbps; onboard propulsion using a resistojet thruster (fuel is water); GPS.

A 1.6 MHz wide, transparent, mode-LS transponder (non-inverting, analogue and digital) will be the amateur part of the payload which will experiment with, and use, different access protocols, also spread-spectrum. It is likely that the spacecraft will use commercial frequencies during weekdays and switch to amateur frequencies at weekends. Transponder and beacon frequencies are to be re-configurable in-flight (qrm avoidance). Megabyte operations are likely to require a 1.5m dish at the groundstation but other groundstation operations will be less stringent.

Target date for completion is April 1997; possibly a flight from Baikonur about June 1997 into an 800km sun-synchronous orbit (G3RWL note: not sure if this is the same launcher as TM-sat). [The Merlion is the national symbol of Singapore (a lion's head on a mermaid's body).]

**Lunar Mission:** UoS mini-sat technology is also expected to be used for the proposed UoS lunar mission around the turn of the century. Just to do it would be quite an achievement but they plan some science and imaging as well as (maybe) placing an instrument package onto the lunar surface. Total cost from initial concept to launch is planned to be about US \$16M.

**SUNSAT:** The South African SUNSAT is a 45 x 45 x 62 cm (60 Kg) spacecraft which will fly on NASA's Oersted launch into



**James Miller, G3RUH illustrating AO-13's orbit for the last time?  
(W2RS photo)**

an elliptical (400 x 800 km) polar orbit; the flight is expected around May 1997. The amateur radio payload is part-digital and part-analogue.

Digitally it will use 1200 bps AFSK (like terrestrial fm packet) as well as 9600 bps (RUH-compatible) with two vhf tx/rx, and two uhf tx/rx; frequencies are stated to be 145.875/955/965 MHz for uplinks and *provisional* downlink frequencies are 437.4 or 437.45 MHz. High data rate mode-LS operation is also planned.

Analogue operations will use a *parrot* repeater on 145.825 MHz. [The parrot repeater will digitally store a period of reception and then retransmit it on the same frequency.]

Other payloads include: GPS; laser reflectors; 15m resolution stereo imaging (on non-amateur frequencies); speech synthesis; school projects and ...a microphone.

The *What comes after Phase 3D* debate was, unfortunately, imperfect due to lack of time and (my) preparation. Results will be published separately but the bottom line was that the (experienced) satellite operators present would prefer a geostationary digital spacecraft, including imaging, operating on microwave frequencies. Information from this forum will be fed into deeper discussions at the AMSAT-NA meeting in Tucson in November 1996.

During the meeting RSGB presented a further donation (about UK £11,000) to AMSAT-UK's Phase-3D funds.

The above are merely highlights of the event; there were many subjects which I have not mentioned - this does not mean they were not interesting; some were fascinating (especially the several sessions about microwave technology).

AMSAT-UK hope to see you next year's event which will (very likely) be July 24-27, 1997. ■

# 1996 AMSAT Field Day Competition Results

Andy MacAllister, WA5ZIB

wa5zib@amsat.org

The 1996 AMSAT Field Day Competition was held June 22-23, 1996 in conjunction with the yearly American Radio Relay League Field Day. Rules for the AMSAT activity were similar to those posted by the ARRL, but with a few key exceptions. While the ARRL rules lump all satellite activity in one category, the AMSAT rules differentiate between activity via different hamsats as separate bands. The AMSAT rules also provide bonus multipliers for digital satellite downloads and uploads of Field Day greeting messages.

The 1996 competition was very active. Every available amateur radio satellite had Field Day participants in pursuit of contacts. Several DX stations joined in the activity. DX stations are encouraged to participate in the AMSAT Field Day activity.

The Hack Shack using the callsign NM1K got high honors this year for the highest point total for portable operation with emergency power, while the North Shores Amateur Radio Club using the callsign WB6LLO came in first overall, operating at home, using emergency power (Table 1). Congratulations are in order for both groups and their efforts with both the digital and analog satellites.

Some problems were noted with loading on the low-orbit Mode-A satellites, but operation via AO-10 and AO-13 was just typical Field Day even though the high-orbit satellites did not provide much apogee coverage for North America. This was AO-13's last Field Day.

The entry sheet was easier to use this year and the rules were easily understood by most of the stations that submitted entries. Electronic submission of the Satellite Summary Sheet via the Internet will be accommodated next year.

Emphasis was placed on digital satellite downloads and CW operation this year. Last year's digisat uploads and downloads were worth five points each, while CW contacts were only worth two. This year they were both given three points.

Many thanks to all of you that operated in this year's event. It was a great opportunity to show other Field Day participants how easy and exciting satellites can be. It was also a chance for some competition on the birds and an occasion to test hamsat radio gear and antennas in emergency conditions.

Rule changes are possible for the 1997 AMSAT Field Day event, but only if warranted. The inclusion of a QRP classification

**Table 1**  
Results of the 1996 AMSAT Field Day Competition

| Pl. | Call   | Pts. | Class | Group Name                            |
|-----|--------|------|-------|---------------------------------------|
| 1   | WB6LLO | 962  | 1E    | North Shores Amateur Radio Club       |
| 2   | NM1K   | 958  | 1A    | The Hack Shack                        |
| 3   | K8RO   | 354  | 4A    | L'Anse Creuse Amateur Radio Club      |
| 4   | N7SFI  | 244  | 1D    | Randy Kohlwey                         |
| 5   | WA0VTU | 203  | 2A    | Pikes Peak RAA + Mountain Radio Club  |
| 6   | N2WM   | 195  | 3A    | Sussex County Amateur Radio Club      |
| 7   | ZS6BMN | 186  | 1D    | Jan Hattingh                          |
| 8   | N8WSG  | 183  | 1D    | N8WSG + N8ULU                         |
| 9   | VE3WCC | 182  | 1A    | West Carleton Amateur Radio Club      |
| 10  | K8EEH  | 147  | 1D    | Henry Ford Community College ARC      |
| 11  | WT1L   | 128  | 2A    | Radio Amateurs of Northern Vermont    |
| 12  | W5IU   | 123  | 2A    | Lockheed-Martin Amateur Radio Club    |
| 13  | AA4SX  | 99   | 2A    | Fort Pierce Amateur Radio Club        |
| 13  | K5DX   | 99   | 2A    | Texas DX Society & AMSAT-Houston      |
| 14  | N1JEZ  | 97   | 1D    | Michael Seguin                        |
| 16  | K7EFA  | 86   | 1A    | Yellowstone Radio Club                |
| 17  | W5XX   | 85   | 3A    | Vicksburg Amateur Radio Club          |
| 18  | K10G   | 58   | 2A    | Ski Country Amateur Radio Club        |
| 19  | K2CT   | 46   | 4A    | Albany Amateur Radio Society          |
| 20  | VE7NOR | 40   | 2A    | North Okanagan Radio Amateur Club     |
| 21  | K6YA   | 21   | 2A    | Electronics Museum Amateur Radio Club |
| 22  | N4DAZ  | 19   | 1A    | Central NC DX Chasers                 |
| 23  | KK5DO  | 16   | 1E    | Bruce Paige                           |
| 24  | KB6A   | 11   | 1D    | Tom Smith                             |
| 25  | N6HM   | 9    | 2A    | Sunnyvale ARES                        |
| 26  | HR2KOS | 1    | 1D    | Lone Ricker + 1                       |
| 26  | W4XD   | 1    | 2A    | MARA/VARA                             |

or special multiplier is a possibility, but the points for CW and digital contacts seem to be about right. What's your opinion? Please send any comments to Andy MacAllister WA5ZIB, AMSAT VP User Services, 14714 Knights Way Drive, Houston, TX 77083-5640.

**Dave Guimont at WB6LLO:** The total number of contacts this year was higher than last. This is attributable, no doubt, to the time-line distribution. Last year the satellites came in *clumps*, and priority decisions had to be made. There was some overlap this year, but we missed less than six passes as a result of timing. Our group concentrated on the digital birds, and it seems as though a number of other stations did the same thing.

When signals were strong, omni-directional antennas were used. The objective was to *save* the rotators on the KLM antenna system. The omni antennas were home brew. Both the VHF and UHF antennas can be built for less than \$25.

In the excitement, we forgot to refuel the generator. Fortunately it *died* between passes! Billy usually pays close attention to the fuel tank, but he had to leave to play in a roller hockey game. Participants included Leanne KA6UCD, Billy, Steve

WB6BDY, Mac W6ZBE, Dave WB6LLO, Reed W6EHR, Red KD7BC and John KF7EHY.

**Rusty Hack at NM1K:** The Hack Shack group (also Enfield ARES) included Russ KA1VEC, Edith KA1VED and Rusty NM1K. Once again we had fun with the AMSAT Field Day.

**Tom Mathison WU8C for K8TO:** Every year it gets better and better. This year I worked six different birds. Lots of fun and good communications.

**Thomas L McDaniel N0NTX for WA0VTU:** We worked seven satellites with emphasis on the 9600 digital birds. We used the *armstrong rotator* method, providing quite a bit of entertainment for our visitors. All went well until shortly after the start of the AO-13 pass. Then Murphy struck! Our power went out due to a damaged AC socket in the line to the generator. This took about an hour to fix, by which time AO-13 was too close to the horizon. Our beautiful tree-encircled location in the mountains has some disadvantages. Do wet, six or seven-inch pine needles attenuate 70-cm signals?

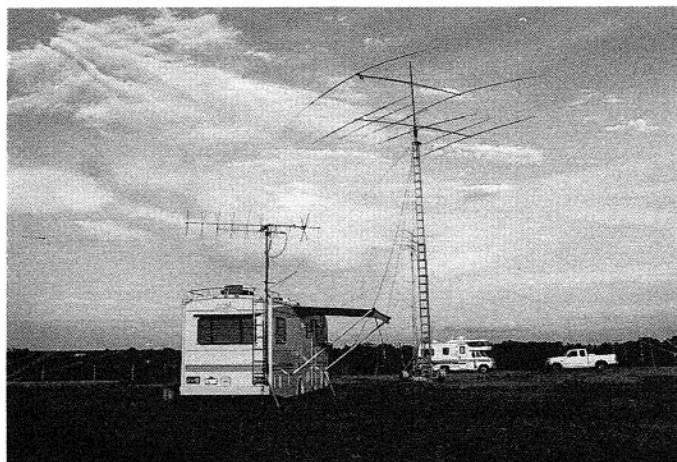
Even with Murphy's visit, we did quite a bit better than last year. The digital birds made a big difference. I would certainly like to have seen more stations on the digital birds, but it was sure nice to see Italian, South African and Spanish stations join in the event. Let's start early next year with announcements on the Internet and the satellites inviting all stations to send *greetings* messages. This could be a good test of emergency traffic handling capabilities through the digital birds.

**John Santillo N2HMM for N2WM:** Field Day for N2WM was held at the Sussex County Community College. The satellite station worked flawlessly, after a faulty mouse used to control the satellite tracking program (NOVA) had been replaced. The contest started out on the right foot when we worked Andy DC2BB in Hamburg, Germany, on FO-20, with an antenna elevation of only one degree above the horizon.

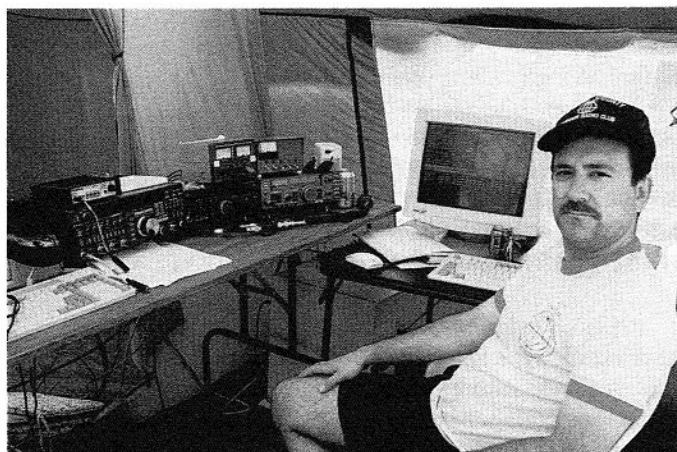
Early into the event, the National Weather Service issued a Tornado Watch for the area. A tornado had just been sighted over the Delaware River in Pennsylvania. Shortly thereafter a thunderstorm hit. Being on top of a hill does not give one a sense of security when you can see the build-up of static charge on the antennas. The build-up was so great that a corona formed on the satellite antennas. What a sight! One of the lightning strikes was so close that it knocked out the six-meter station by damaging the transverter.

During the storm it rained so hard that a small stream of water flowed through the center of the satellite tent. Finally the rain abated and we got back to operating. My new-found digital satellite station worked very well, for it's first time on this mode. I'm looking forward to incorporating the TAPR DSP-93 into my satellite station.

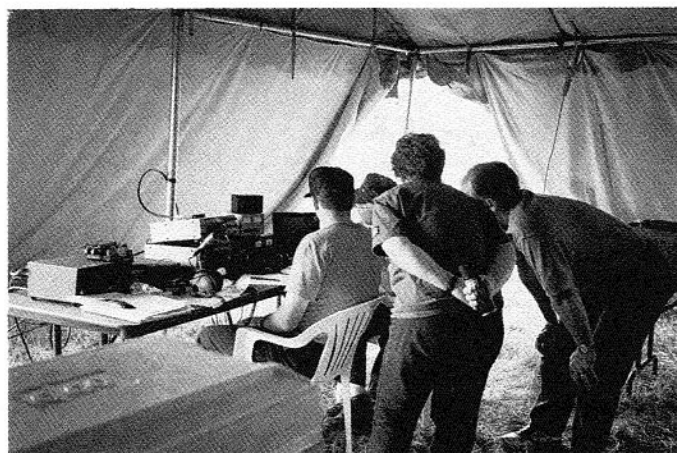
Setting up a satellite station for Field Day is challenging and rewarding. It shows other hams and visitors to the site what the satellite discipline is all about. I need to thank Dawn N2NKF, Dave KB2TBZ and Fred WA2DFC for their support of the satellite Field Day operation.



Beams from 40 meters through 70 cm at the K5DX Field Day station.



John Santillo, N2HMM, at the Sussex County Amateur Radio Club (N2WM) Field Day site.



K7EFA satellite station operators waiting for an AO-27 pass: Vince Fiscus, KB7ADL, Bernie Miller, N7DQU and visitors.



**Jan Hattingh at ZS6BMN:** I am pleased to hear that my participation in the Field Day competition earned some points for the others, and great to hear that I am regarded as a legal participant :-). The idea was to add a bit of DX flavor to the event. I operated with commercial power from my home station. The progress of AO-13, on its way down is followed with interest. Take care!

**Jeff Milne VE3EFF for VE3WCC:** The AMSAT competition was a success this year for the West Carleton Amateur Radio Club this year. We managed to work all birds except AMSAT-OSCAR-27. The majority of the equipment including antennas, transverters, preamps and modems were homebrew. New for the club this time was demonstrations of digital satellite operation and WiSP software. Operators included Dave VE3PYG, Gary VE3XG, Phil VE3CIQ and myself.

AO-13 was out of reach from the east for us with the exception of a few fast contacts. AO-10 activity was slow with only a dozen CW contacts in the wee hours of the morning. As usual, the LEO's were really loaded.

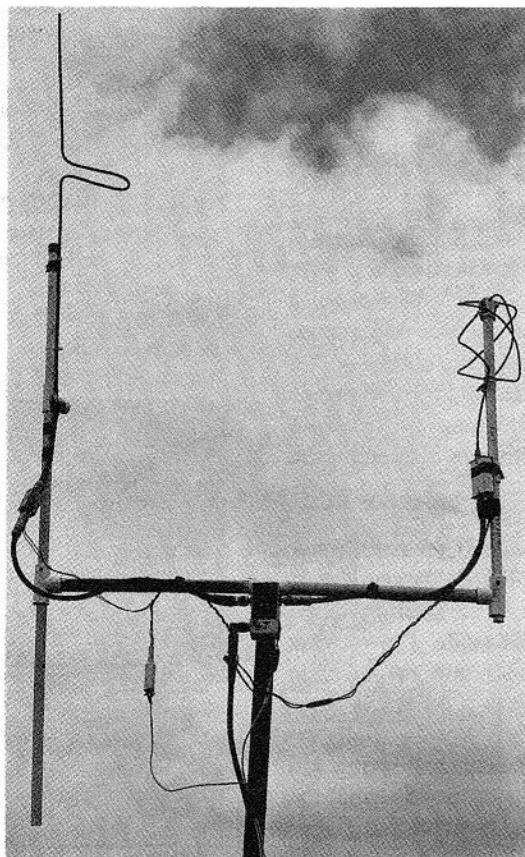
All of Sunday was dedicated to working on some untested 9600-baud gear. We were willing to forgo points to try something new, culminating with success. One final comment; we would like to see more Canadian stations in the AMSAT competition!

**Tom Whitney N1GZZ for WT1L:** The Radio Amateurs of Northern Vermont operated their satellite station near Williston this year. Tom N1GZZ brought out his station and operated via AO-10, AO-13, FO-20, KO-23 and KO-25.

The rain was a bit tough for the first 18 hours. However, the satellite tent was a quiet place at the site and was a popular napping spot. Many demonstrations were given when the *nappers* woke up as the generator was started. It was too bad that AO-13 was so low on the horizon for the east coast. The terrestrial packet station had a habit of overloading the two-meter preamp, but due to relatively little



A water-filled soda bottle provided a counterweight for the antennas at the VE3WCC West Carleton ARC 1996 Field Day site.



Homebrew omni-directional antennas for VHF and UHF work at WB6LLO Field Day station. (See article on page 16)

Mode-B operation, this was not a problem. The whole satellite station, including the desk-top 386 PC for WiSP and KCT/T was operated on a 350-Watt generator using a 12-volt battery for the low-duty cycle transmit power. The battery was easily charged between passes and we ran the whole weekend on less than six quarts of gasoline! Can't wait till next year, but let's hope we have a new DX bird!

**Doug Howard KG5OA for W5IU:** Although we didn't have the winning score this year, we had a great time operating through both the analog and digital amateur satellites. Participants included Keith W5IU, Randy N5SVW, Donna N5WOE, Harold K5SXX and myself.

**Roger Snyder KC4NHB for AA4SX:** Field Day this year proved that Murphy was an optimist! Just about everything that could go wrong, did. Our first problem was the lack of an HF radio for the RS birds. It was the old story that ANYONE could have brought one. EVERYBODY thought that SOMEBODY would bring one. As a result, NOBODY did! Next we had a problem with the generator. The voltage was a little low, which caused the UPS to switch over to the battery. Needless to say, that did not last very long.

We experienced a great deal of RF interference from the two HF stations, both in the radio and in the computer. It seemed to be getting into the computer through the keyboard. It was strange to watch the computer typing by itself. We tried to minimize the problem by unplugging the keyboard when it was not in use. I'll bet I plugged and unplugged that keyboard five hundred times.

Other problems included new antennas with a bad phasing harness. Linear polarization worked much better with the harness gone. Callsign swaps in WiSP and some computer resets got confusing. Our digisat greeting message ended up posted under KC4NHB and AA4SX, but I believe we did fairly well on the digital birds.

Brief activity via AO-13 was fruitful and we also had good luck with AO-27. I did not observe any poor operating practices that have occurred in years past. Exchanges were brief, and many stations made contacts.

We had a good time, and I am sure it was a valuable learning experience for everyone who was involved. The best part was having my picture in the newspaper again :-)

**Andy MacAllister WA5ZIB for K5DX:** This was a Field Day to remember. The Texas DX Society really did this one with style. The Friday night BBQ was fantastic, the homebrew beer was excellent, the microwave ovens in the RV's never missed a cycle, we used balloons to raise some antennas, and the air conditioning was a fine relief from the South Texas heat... The satellites were fun too! We had some problems with generator noise in the 9600-baud receiver system, but the analog hamsats cooperated nicely.

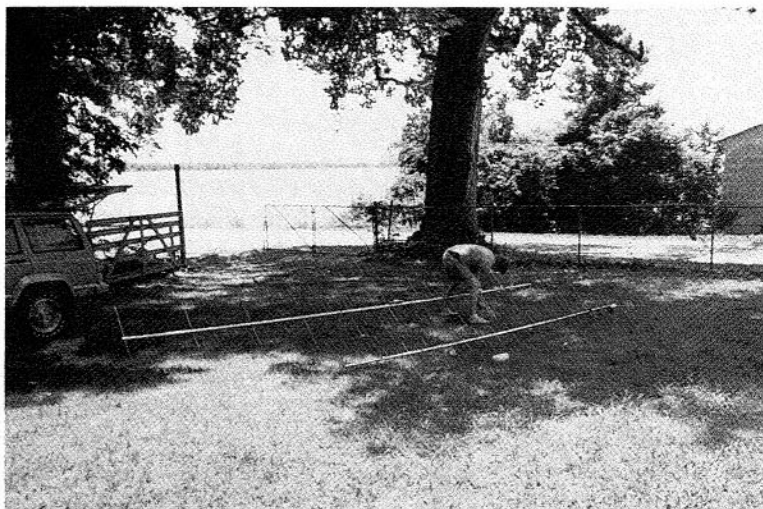
The signals from AO-10 were a bit weak, but we made both SSB and CW contacts. AO-13's last Field Day will not be forgotten. Since its launch, it has been the mainstay of many Field Day activities. In years past we have used Modes B, L, J and S via AO-13. This year Mode B had to suffice. Next year we'll have the bugs out of the digital system, so watch out!

**Mike Seguin at N1JEZ:** I had a great time! Sure wish the AO-13 pass had been longer. We had a very short window here in the northeast. Very few seemed to be on AO-10 after it passed 20,000 km on its way to apogee. I made six contacts during this time. Considering the shape of AO-10, these were real weak-signal contacts down in the noise floor...truly enjoyable to work hard and make the exchange!

**Russ Tillman KC5JVB for W5XX:** The Vicksburg Amateur Radio Club operated W5XX from the shores of Eagle Lake, next to the Mississippi River. Fighting heat, fire ants and mosquitos, 85 satellite contacts were made during Field Day activities, allowing visitors a good demonstration of satellite operations. AO-10, AO-13 and FO-20 provided a majority of analog contacts. The most memorable and fun pass was AO-13, which was worked by Eddie N5JGK during the wee hours (1000 UTC) of the morning.

**Dave Jones WB2YLR for K2CT:** This year all of our primary satellite gear was installed elsewhere at Bethlehem High School awaiting a scheduled SAREX QSO on June 26th. We did manage to pull together some antennas and rotators to get on the birds. We'll be back to normal next year!

**Omri Serlin AA6TA for K6YA:** This was the third and best Field Day with satellite operations for EMARC (Electronics Museum Amateur Radio Club of Los Altos, CA). We were set up to work four satellites, and indeed worked all four (AO-27, FO-20, AO-10, AO-13). The set up included an 18-element, CP KLM, 70-cm beam and a small, five-element log-periodic array for two meters (horizontally polarized). The antennas were mounted on a PVC-pipe cross boom and a 1.5" PVC-pipe mast, all on a small tripod. The contributors and/or operators included Andy AC6GN, Jurgen AC6HQ and Omri AA6TA.

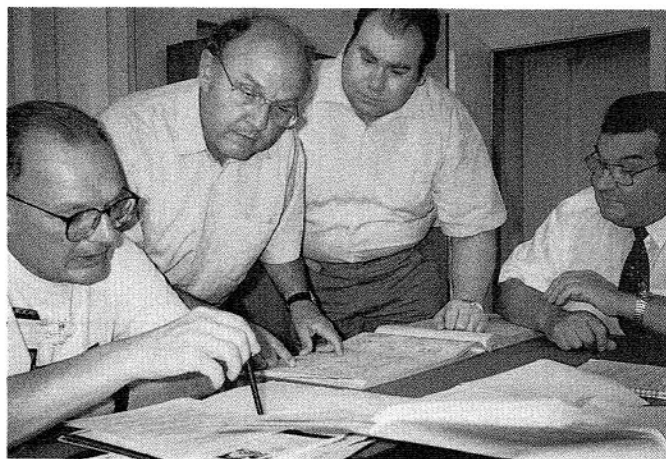


**Eddie Pettis, N5JGK setting up the Mode B antennas for station W5XX on the shores of Eagle Lake, Mississippi. (KJ5OB photo)**

**George Hopkins KF6GL for N6HM:** We had the satellite (AO-13) for 35 minutes. We changed operators for each contact to let everyone who wanted to make a contact get on the air. The signals got weak quickly. When the satellite switched from omni to beam antennas, we quit. It was worth the trouble. We signed up at least one new satellite op!

**Ricardo Denis at HR2KOS:** This year was terrible for me. Two weeks before Field Day I lost my HF rig, and one week later I lost my two-meter rig and my home computer. Not wanting to let FD '96 go to waste, I convinced a friend to come over (with his HF rig, hi!) and allow me to show him what Field Day was like on the satellites (mostly RS-12). Thus if you hear a new HR station on the satellites in the very near future, then I will consider my AMSAT FD performance a success!

**David Gordon KB4LCI for W4XD:** Boy! RS-10 and RS-15 were very active and crowded. Glad to see all those stations working through the LEO's! ■



**Phase 3D project workers meticulously compare new plans using the Red Book at the AMSAT-DL Laboratory in Marburg, Germany. The Red Book contains the entire as built drawings and schematics package for the AO-13 satellite and many of Phase 3D's systems will closely resemble those proven designs. (KB1SF photo)**



# A Microsat J Pole Antenna

Dave Guimont, WB6LLO, [wb6llo@amsat.org](mailto:wb6llo@amsat.org)

This 435 MHz J pole antenna was developed to provide Microsat reception coverage from horizon to about 30 degrees elevation. Meanwhile, a quadrifilar antenna described in an article titled *Quadrifilar Antennas for Amateur and 137 MHz Satellites* (*The AMSAT Journal*, March/April 1994) provides coverage above 20 degrees. As a result, the combination of these two antennas provides about 80 percent of the thruput of a pair of Yagi antennas using azimuth/elevation control. I use a relay at the antenna to manually select the "J" pole from the horizon to 30 degrees elevation, and the quadrifilar above 30 degrees elevation. Also, since a majority of microsat passes will be below 30 degrees elevation, the J pole would be the antenna of choice if you are going to operate with one rotatorless antenna. Chris Hill, VK6KCH, is developing software to enable computer control between these two antennas.

The 435 MHz J pole antenna is inexpensive and easy to construct. Make sure to use good quality coax and connectors. Also to reduce line loss, make the cable run between the antenna and transceiver as short as possible, and use care in attaching the connector. To boost the signal, I use inexpensive Hamtronic pre-amp mounted *at the antennas*. Figure 1 shows the pre-amp mounted at the connector and also displays the "J" and the quadrifilar mounting system. A pre-amp is mounted at each antenna before the relay. This may be *over-kill*, a single pre-amp just after the relay will probably work just as well.

Figure 2 shows the two meter uplink version of the J pole. It is on a separate mast, but could be placed on the same mast as the receive antennas. Figure 3 displays the parts required for assembling the tuning section. The lower tuning tube is soldered to the mounting bolt. Figure 4 shows a close-up of the tuning section after assembly. Included are the inner brass tube, outer brass tube, mounting bolt through pvc "T," coax braid pigtail, and solder lug.

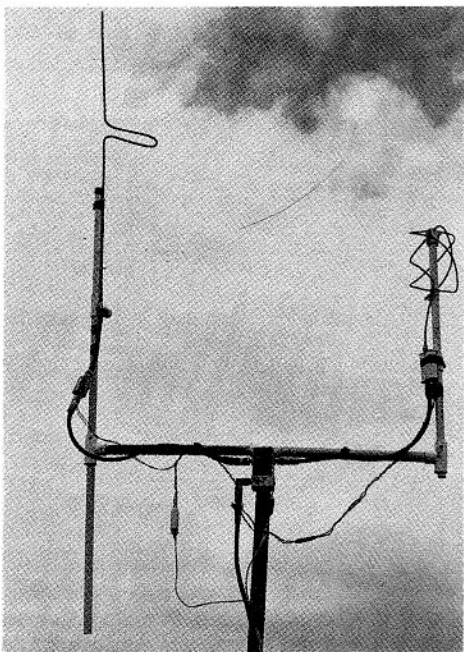


Figure 1. Combination J-Pole and quadrifilar antennas.  
(WB6LLO photo)

## Assembly Instructions

1. Mark the wire at 13 1/2", 6 3/4", 6 3/4". The marks should wind up at the center of the bends. Make the first bend of 90 degrees at the 13 1/2" mark, the second bend of 180 degrees at the next mark, and the final bend of 90 degrees at the last mark.
2. Install the coax connector. Prepare the other end by removing 1 1/2" of the outer jacket. Ravel the outer braid to the outer jacket and twist to provide ~2" pigtail. Solder lug to the end of the braid. Remove the exposed dielectric being careful not to nick the center conductor. (I just could not resist saying that!!) Overlap the center conductor by 1/2" on the bottom of the collinear section and twist on a layer of small diameter tinned wire. Use a large heat sink on the center conductor and solder properly. High current here!!
3. Drill a hole in the tee to accommodate the 8-32 screw that mounts the tuning section 1/4" from the shoulder of the tee. I originally cut a slot in the "T" to provide another tuning adjustment, but the sliding brass tube section provides adequate adjustment.
4. Assemble the 2" screw, washers, solder lug, nuts to the stub. Solder the 3/16" tube with about 1/2" overlap to the machine screw.
5. Use plastic cable ties to secure the element to the pvc mast, and drill a hole to secure the coax assembly to the mast with the cable clamp. Adjust the element to provide ~1 center to center spacing from the tuning portion.
6. Clean the inside of the outer tube, and the outside of the inner tube to insure good electrical contact. Squeeze the top of the outer tube gently to provide a tight sliding fit for the inner tube.

## Parts List

| Materials                                                         | Amount                                          |
|-------------------------------------------------------------------|-------------------------------------------------|
| #6 (.161) copper wire                                             | 46 1/2" (or 1/4" OD copper tube)                |
| Coax 9913                                                         | ~7"                                             |
| N connector                                                       | 1                                               |
| 3/16" od brass tube                                               | 1 1/2"                                          |
| 5/32" od brass tube                                               | 1 1/2"                                          |
| Machine screw                                                     | 8-32 x 2"                                       |
| Nuts, washers, solder lug                                         |                                                 |
| for above machine screw                                           | 8-32 x 1 1/2"                                   |
| Nuts, washers, cable clamp to fit coax for above Schedule 40 PVC: |                                                 |
| Top section                                                       | 1/2" x 20"                                      |
| Bottom section                                                    | 1/2" x ~3' (determined by your mounting method) |
| Tee                                                               | 1/2"                                            |



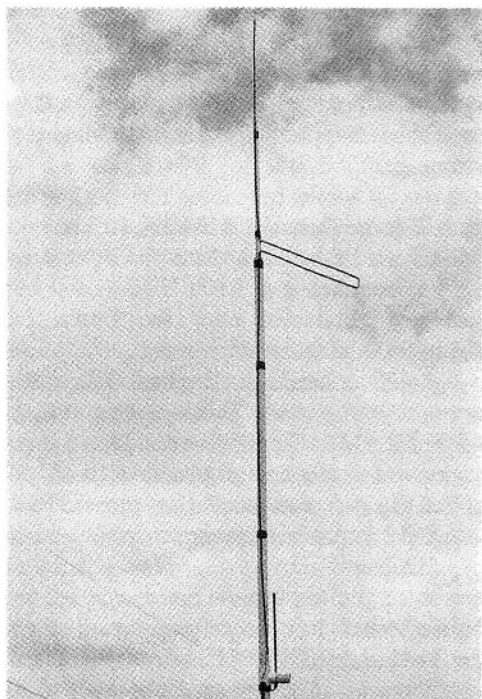


Figure 2. Two-meter version of J-Pole antenna. (WD6LLO photo)

7. Connect to an RF source, and slide the outer tube for the best SWR. The overall length of my stub, including the mounting bolt is 4 3/4". Solder the tube. Seal the exposed end of the coax with a good gob of RTV or similar sealant.

#### Notes

a.. The diameters are not that critical and reasonable substitutions can be made, particularly if you have access to test equipment. Stay close to these dimensions, and no tuning should be needed. Experienced builders will not need these detailed instructions; the figures will supply necessary information.

b. 1/4" OD copper tubing may be easier to obtain, and will work just as well. Cut a piece about 2" longer than the finished antenna. Mark the bends as described above, and anneal about two inches each side of the marks. Even new copper tubing work hardens rapidly so it is best to do the annealing procedure. Squeeze one end in a vise, and fill with fine sand. Squeeze the open end shut and make the bends.

c. For a 2-meter version multiply the element lengths by 3. Use 1" schedule 40 PVC for the lower section. Graduate to 3/4" PVC at the phasing portion.

d. Best place to contact me for questions and suggestions: [wb6llo@amsat.org](mailto:wb6llo@amsat.org). I do get on the digital birds once in awhile....73 Dave ■

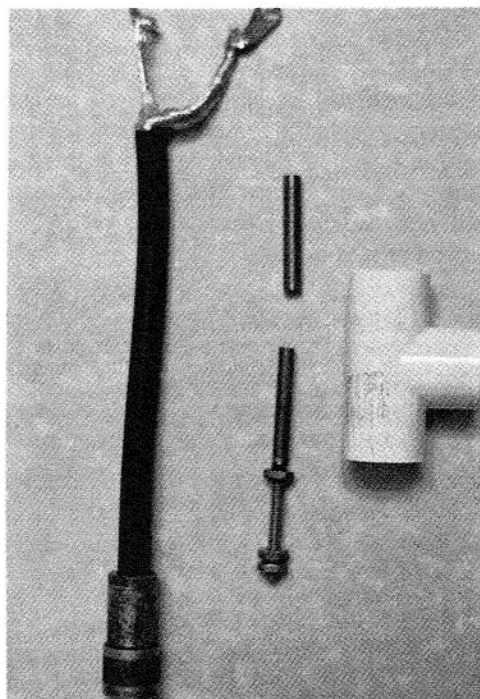


Figure 3. Materials required for tuning section. (WD6LLO photo)

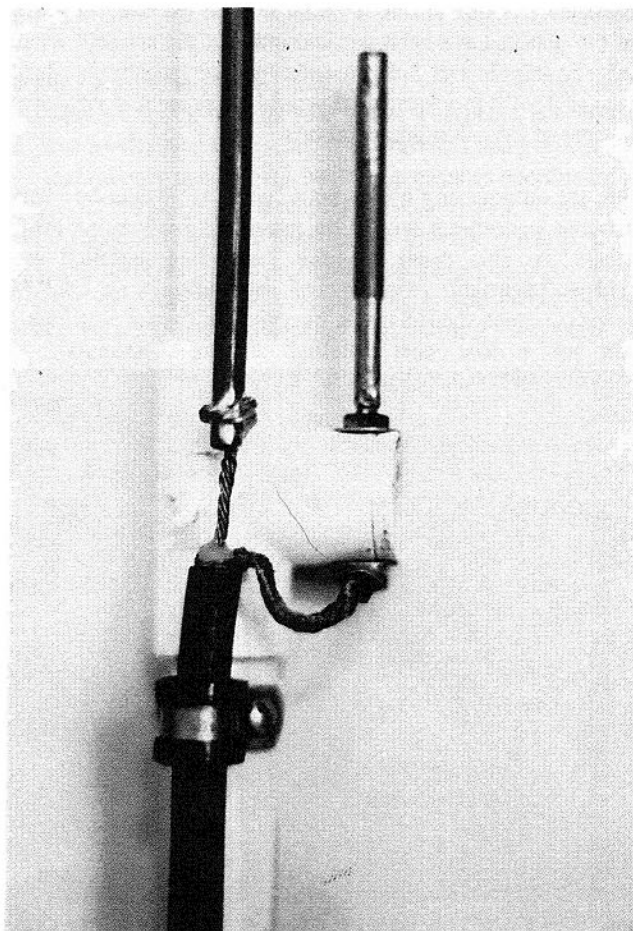


Figure 4. Tuning section assembled. (WD6LLO photo)

## Field Ops Update:

# Field Operations and The 1996 AMSAT Space Symposium and Annual Meeting

Barry Baines, WD4ASW, [wd4asw@amsat.org](mailto:wd4asw@amsat.org)

The 1996 AMSAT Space Symposium and Annual Meeting will be held the weekend of November 8-10 in Tucson, AZ. AMSAT members received a symposium announcement in the mail, and there is a similar pronouncement in this issue of the Journal. Meanwhile, Larry Brown, NW7N, and his team are busy preparing an outstanding weekend of AMSAT activities, presentations, and related events.

From a Field Operations perspective, we will be holding our annual Area Coordinators Breakfast on Sunday morning. Check the agenda sheet for room location and time. Everyone interested in the field organization is welcome to attend as well as those who may be interested in becoming part of the Team. This is a great opportunity to meet fellow Coordinators, share ideas, and have discussions on what we are doing and what else needs to get done.

A new presentation format will be taking place this year that will be of interest to Field Ops. While there will be a variety of presentations on various AMSAT subjects tailored to those already involved with AMSAT and satellites, Larry has taken the additional step of creating opportunities for non-AMSAT members to become familiar with satellite operations through a comprehensive "Beginner's Workshop" that will run during a portion of the Symposium. As this article is being written (in late August), not all of the details have been worked out, but the concept would be to tailor materials and 5-6 presentations for 'beginners' during a portion of the Symposium that would be presented concurrently with some of the other presentations.

We are anticipating a four hour 'window' where an overview of satellite operations would be presented by various AMSAT members. At this point in time Larry has recruited several individuals to provide overviews of satellite tracking, QRP Mode A operations with the RS birds, overview of digital satellites, how to set up a low cost satellite station, antennas, and construction/operation of a Phase 3 class station.

I intend to highlight the field organization and encourage new users to contact their Area Coordinator for assistance. We will also

provide 'resource listings' developed by Gary Rogers, WA4YMZ, as part of our package. There will also be a functioning satellite station, and hopefully some of the attendees to the Beginner's Workshop will have an opportunity to see a station in operation and make some contacts.

In addition, George Caswell, K1MON, will be conducting his weekly AMSAT net Friday night from the Symposium site. The net, scheduled to commence at 0100 UTC (1800 MST) will be phone linked and conducted over the Derry, NH repeater (K1MNS/R-146.85 MHz). An impressive series of AMSAT nets are held throughout Northern New England with six different nets held on four nights of the week. This is an opportunity to observe one such successful AMSAT operation conducted at the local level and perhaps gain some ideas on how to conduct an AMSAT net that could be applied to your area as well. I am sure that George will be offering his net participants a chance to speak with some of the Symposium participants.

The Tucson team has been publicizing the Beginner's Workshop at various hamfests throughout the West as well as sending announcements to local ham clubs. Individuals attending the Beginner's Workshop will be registered as full participants at the Symposium and receive a copy of the Symposium Proceedings as well as be given an opportunity to attend the banquet. The advent of a beginner's program at our Symposium is an excellent idea.

There is an increasing interest in conducting 'satellite workshops' in conjunction with hamfests and other events in order to encourage interest in satellites. Keith Baker, KB1SF, ARRL's Steve Ford, WB8IMY, and Rosalie White, WA1STO, and I conducted a six hour workshop in conjunction with the 1995 ARRL New England Convention in Manchester, NH. There has been interest expressed by other hamfest organizations to conduct similar workshops in 1997. There are significant benefits to conducting such workshops, including: 1) the ability to cover the satellite field with some detail; 2) an audience that is committed to spending the time to allow presenters to discuss their subject; 3) more efficient distribution of presentation materials since in most cases the audience registers to attend in advance; 4) given the extensive nature of the program, provides an opportunity to collect registration fees which supports the satellite program; and 5) increases AMSAT's recognition since well prepared and presented workshops create favorable publicity.

The Tucson workshop offers a good opportunity for AMSAT members to see firsthand some excellent 'familiarization' presentations that you may wish to adapt to your presentation library for use with your local clubs and groups. AMSAT members are certainly encouraged to attend some of the presentations and use the opportunity to learn what materials are available.

Many thanks to Larry Brown, NW7N, and his team for making the extra effort to increase the scope of our audience by incorporating these attendees into our annual Symposium. ■



At the AMSAT-DL Laboratory in Marburg, Germany, AMSAT-NA Vice President for Engineering Dick Jansson, WD4FAB (R) holds a prototype L Band antenna feed that was constructed by Freddy de Guchteneire, ON6UG (L) (AMSAT-NA photo by Keith Baker, KB1SF)

## Operating Portable at the BARC Hamfest

Michael Seguin, N1JEZ, [mike73@aol.com](mailto:mike73@aol.com)

**I**t all started in the middle of a Friday afternoon. Suddenly, out of nowhere, three vehicles came screeching to a halt in front of the *Old Lantern Campground* in Charlotte, Vermont. Out popped three individuals mumbling things like *azimuth* and *elevation*. They scurried to the south side of the building, with GPS and Inclinometer in hand, and proceeded to look up and around. At this point, one was heard to exclaim, "We only need 10 degrees to clear the building. Excellent!" Make no mistake about it, AMSAT has arrived!

The town of Charlotte in Vermont is the site of the annual Burlington Amateur Radio Club Hamfest. This year featured a portable satellite demonstration. The AMSAT crew consisted of Tom Whitney, N1GZZ, a newly appointed AMSAT Local Area Coordinator, Beau Bushor, N1MJD (We've been calling him a space shot for years....) and myself, a confirmed satellite crazy. The decision was made early on to concentrate on LEO operation, both analog and digital, mainly because AO-10 and AO-13 were on the other side of the planet and wanted nothing to do with us! Tom brought his satellite setup along. It consisted of a tripod mounted G5400B rotor system with a KLM 40CX and a 2M Cushcraft linear antenna. Mike brought along his SSB 70 cm preamp for the downlink. We planned on operating KO-23/25, FO-20 and AO-27, so we only needed 70 cm receive capability. Tom also had his ICOM radios with digital mods, TNCs and his 386 computer with KCT running WiSP. On the analog side, Mike brought his Yaesu FT-736R and a laptop with external monitor to show off InstantTrack and NOVA. He also had packed his portable (don't leave home without it) AO-27 system.

Saturday morning arrived with the site totally socked in with fog. Inside, we quickly hung the AMSAT banner, and set out all the materials that Martha had so graciously sent us. At 8:00 am, Mike was on working the early FO-20 pass. People were starting to filter in. We had wired a small PA amplifier off the receive side of the data jack on the back of the Yaesu 736R. This works excellently because it's buffered from the normal audio path. The level is constant and not affected by the front panel volume control. As soon as Mike made his first contact, the room started to fill. People were wondering why the voices from the speaker were changing pitch as they talked. Naturally this led to discussions of Doppler shift and the need for full duplex operation. Meanwhile, Beau was behind the AMSAT table giving out advice as people were making donations to help us build and fly more birds. Outside, the fog had lifted. Inside, the satellite demo was underway!

Soon after the FO-20 pass, Tom fired up Wisp. KO-23 popped into sight, and the TNC came alive receiving data. Suddenly, Wisp began to transmit. A quick look at the upload queue, showed messages left over from Field Day. Oops! Tom jumped into action and

decisively deleted the old messages! He then uploaded a greeting about our portable operation from Vermont. The folks who stopped by to watch were amazed as WiSP went about uploading and downloading data, and also tracking the antennas. We had posted signs listing the various satellite passes we were going to operate that day. One young lady stopped by and asked, "What's a portable AO-27 pass?" Mike responded, "Funny you should ask, let's head out to the parking lot."

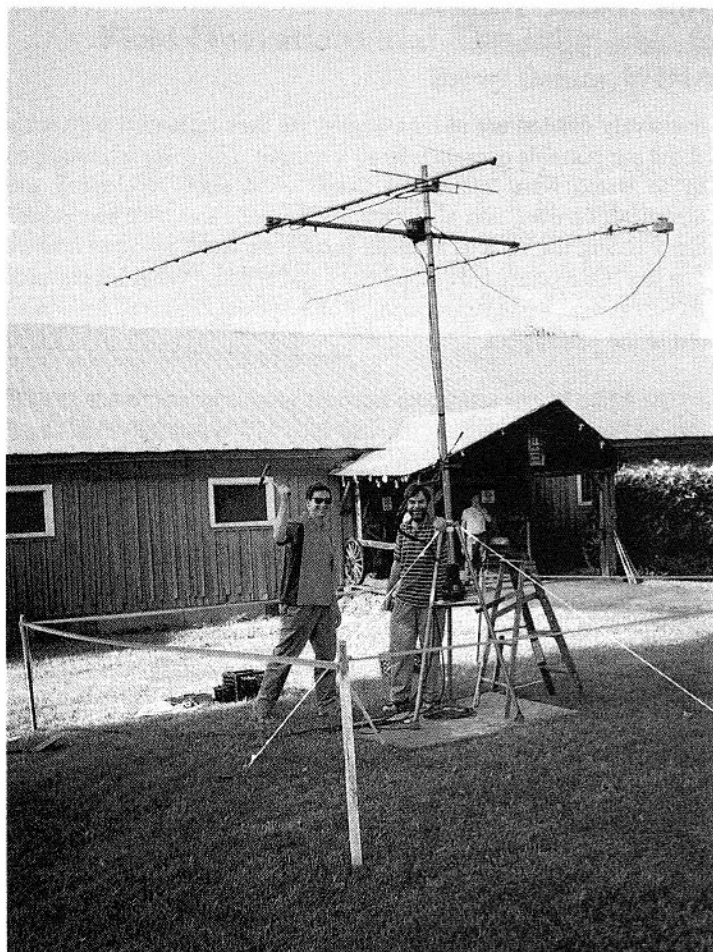
As Mike began setting up outside, people began to congregate around him. He explained that what they saw was a fully functional portable satellite station. You could see the disbelief in their eyes. The station consisted of a tripod mounted 5-element 70-cm Yagi, connected to an ARR 70 cm RF switched preamp. This fed into one port on a Diamond duplexer, which then hooked to a Yaesu FT-470 dual-band HT. The other port of the duplexer ran over to a Radio Shack 2M HT amplifier which fed a 2-meter 5/8 wave mag mount antenna sitting on the ground some distance away. He discovered the 5/8 wave works much better on the ground, even on high passes! With the HT and brick, Mike was able to use 1/2, 3, 10 or 25 watts on the uplink. Dangling off the HT was a speaker microphone, with an external speaker plugged into it so he wouldn't get feedback and people would be able to hear the downlink. The whole mess was powered by a 12 volt, 6 amp Gel cell. Finally, the milk crate that was used to haul all this around, became a convenient stool to sit on.

Mike patiently explained how AO-27 was an FM bird, and that it was easy to uplink to. The real secret was being able to hear it well. That is why he used a small Yagi antenna and preamp. He did admit that he only used an RF switching preamp because he had a bad habit of forgetting to switch the transmit side of his HT and would occasionally send 3 watts of RF into the preamp. If it was not RF switched, he could probably kiss the preamp goodbye. He was quite sure this memory lapse was a side effect of having survived the 60's, and had nothing to do with RF exposure. Soon



Mike, N1JEZ outside working AO-27 with young friend Jenny and other hams looking on. (N1MJD photo)





Tom, N1GZZ, (left) AMSAT Local Area Coordinator puts the final touches on the satellite array while Mike, N1JEZ gets in the way (as usual)! (N1MJD photo)

after, AO-27 came up over the horizon. The rush from the unsquelched speaker began to quiet and the S-meter was showing a downlink signal. Mike made a quick contact with 3 watts on the uplink. By now, a dozen people had gathered around. Suddenly, he heard KA2UPW. He quickly lowered his uplink power to 1/2 watt and worked Doug. They had been sending e-mail back and forth looking to work each other QRP HT to HT. They made the trip! At this point, Mike turned the microphone over to Jenny, the young lady who had asked him inside about portable operation. She was able to talk to a ham in Ohio! The look on her face made all the hard work worth it.

Meanwhile, back inside, Tom was running a KO-25 pass. He downloaded a few responses to his greeting and a message from a ham that had just worked the portable AO-27 operation in the parking lot. These messages made for some interesting reading as Tom showed WiSP to curious hams who stopped by.

Our demonstration was a success! Satellite operation in Vermont is not well established. We hope to change that, promote AMSAT and generally have fun as we operate from more of the hamfests around Vermont. ■

Stay up-to-date on news of the  
AMSAT Symposium and Annual Meeting via:

<http://www.amsat.org.amsat/sympos96.html>

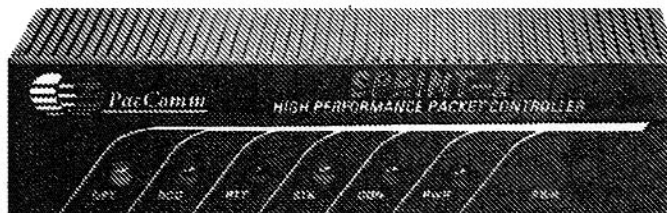


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# Minutes of the AMSAT Board of Director's Meeting

*Held June 29, 1996 in Silver Spring, Maryland*

**Transcribed by Bill Hook W3QBC**

*Editor's Note: Items in [ ] are reports of actions and events that have occurred since the meeting and are included for the sake of closure.*

The meeting was opened at 9:00 am on Saturday June 29, 1996 at the AMSAT Business Office, 850 Sligo Ave., Silver Spring MD. Members of the Board of Directors (BoD) in attendance were Keith Baker KB1SF, Tom Clark W3IWL, Dick Daniels W4PUJ, Andy MacAllister WA5ZIB and Bill Tynan W3XO. Junior deCastro PY2BJO and Bob Myers W1XT were unable to attend.

Others participating included Martha Saragovitz Corporate Secretary, Frank Bauer KA3HDO V.P. for Manned Space Programs, Art Feller KB4ZJ Treasurer, Ray Soifer W2RS V.P. International Affairs and Perry Klein W3PK Founding President and V.P. for Government Liaison. At various times others participated by telephone. These included Barry Baines WD4ASW V.P. User Services, Heather Johnson N7DZU 1996 Annual Meeting Committee Chairman, Stacey Mills WB4QKT AO-13/P3D Command Station, Russ Tillman KC5JVB, Editor, *The AMSAT Journal*, and Paul Williamson KB5MU V.P. for Electronic Publishing.

## I. Organizational Matters

President Bill Tynan opened the meeting with an announcement that AMSAT is financially solvent with current assets of \$254k plus investments valued at approximately \$500k. Thus far, approximately \$691k have been contributed toward the Phase 3D project (P3D) by approximately 4000 individuals. In addition, ARRL has raised and provided approximately \$525k, \$200k of which was sent to AMSAT-DL as our share of the initial launch payment. Pledges still unmet amount to approximately \$80k. Bill said that we are faced in the near future with major expenses for P3D that may deplete these resources so additional contributions are needed. He said that a campaign will begin this summer offering a special plaque dedicating a portion of the P3D spacecraft to those organizations and individuals who have donated major spacecraft components or \$2,500 or more in cash. Bill asked for help in preparing a list of such donors so that no one is overlooked. He expressed the hope that some of the previous donors, who have not contributed that amount, will contribute additional funds in order to bring their total up to the \$2,500 level. Tom questioned whether the P3D donor lists appearing in recent issues of *The AMSAT Journal* might have missed some of those who contributed funds early on before the present donor database was created. For example, he had not seen his call listed. Andy had a similar comment. [A subsequent check of the list revealed that both W3IWL and WA5ZIB do appear.]

It was emphasized that any contributors who might have been inadvertently left off the published list will be acknowledged, if such omissions are called to the attention of the AMSAT office.

Art Feller reported that the annual financial audit is being prepared by our accountants and it should be completed sometime in August. This will include justification to the IRS of our tax-exempt status.

## II. Membership

Martha announced that AMSAT membership remains near 7000 with the renewal rate more impressive than the gain in new members. The possible reasons for this slow growth in membership were discussed at some length. The lack of recent satellite launches was cited as the most probable cause. It was decided that in the coming year to place fewer solicitations for new members in the Amateur Radio journals and to dedicate more effort toward deriving income from donations given in exchange for AMSAT's books and software with an emphasis on the newly offered Nova tracking program. Ray Soifer noted that *OSCAR News* routinely includes an insert listing all the computer software, books and hardware items that AMSAT-UK offers as a service to members. It was concluded that Martha will investigate the feasibility of placing a similar form to be inserted in each issue of *The AMSAT Journal*. Tom Clark suggested that arrangements should be made to make it possible to order these things through our Web site. This suggestion was deferred until Paul Williamson was able to join the meeting via telephone.

Martha reported that the project to ask the AMSAT Life Members for voluntary contributions to help support the cost of sending them *The AMSAT Journal* has produced good results, although a number of replies came in that were illegible. Some were received indicating that the Life Member was deceased. Bill Tynan noted that he had received approximately a dozen letters complaining that AMSAT is pressuring them into further payments when they had, in good faith, paid for Life Membership. Bill said that he was sorry to receive such responses and that every effort had been made to make it clear that any contributions are voluntary and that no living Life Member will be dropped from the Journal mailing list for lack of contribution. He also noted that other organizations, such as IEEE, have similar campaigns.

[In a report prepared by Martha following the meeting, the following figures were revealed:

- Life Members who made voluntary contribution - 384 (\$11,250)
- Life Members who want to continue receiving *The AMSAT Journal* but do not feel they want to contribute - 505
- Life Members who no longer want to receive *The AMSAT Journal* - 162 (They remain Life Members and will continue to receive annual ballots.)
- Life Members reported to be deceased - 22
- Life Members who did not respond and will be considered as not interested in continuing to receive the Journal - 44

These people will also continue to receive annual ballots.]

## III. Publications

It was noted that more articles describing Amateur Radio space activities are needed for the ham magazines. Keith Baker noted the articles and regular columns which have appeared recently, including Andy MacAllister's 73 *Amateur Radio Today* column. Bill Tynan noted that prospective authors are encouraged to write AMSAT-related articles for the

various amateur publications. Tom Clark observed that Amateur Radio news items being published electronically are gaining an ever-increasing readership. He stated that space-related items were being covered well by the electronic media. Paul Williamson will be asked to inform the Board as to the current number of users per day handled by the AMSAT Web server when he joins the meeting.

Following a member's suggestion, an agenda item was included to consider offering members the option of receiving *The AMSAT Journal* by electronic means. Paul Williamson had been asked specifically to be available to address this item. He joined the meeting by telephone at this point. Tom Clark suggested that the costs of electronic publishing are significantly lower than those for printing and mailing a paper issue. Martha advised that the present cost of printing the Journal is approximately 50 cents per issue and that the mailing cost per issue is 21 cents for domestic members and approximately \$1 for overseas mailings. Paul Williamson questioned whether or not the technology is at present mature enough to make this approach feasible and asked the following questions:

- Who would be able to provide the considerable investment in time and work required to create the electronic issue?
- Who would provide the costly software needed, including that required to restrict access to members?
- What method would be used to incorporate photographs and technical drawings?

Bill Tynan also wondered how distribution could be limited to AMSAT members. Williamson said that this posed problems and that even if it could be done, it would be easy for anyone to make additional copies on their computers and give, or sell, them to their friends. Tom Clark commented that CD-ROM distribution be considered as another form of electronic distribution. It was noted that a single CD-ROM has much more capacity than is needed for one Journal issue and that if this approach were taken it would have to involve much more than a single Journal issue. Although no formal vote was taken, there was a consensus among the Board members that optional electronic distribution of the Journal does not appear feasible or worthwhile at this time.

Despite the above decision, Tom urged that continuing thought be given to more use of the newer software tools to produce the Journal and once these are in place, the question be re-considered. Tom made the point that such tools make it easier to cross-reference various items, when the publication is received electronically. It was decided to make this suggestion to Russ Tillman, once he joins the meeting by telephone.

Tom revived his suggestion that a form appear on the AMSAT Web page that lists all of the software, books and trinkets which we offer. After some discussion, it was concluded that, because of security considerations, the form should provide only for people to print it out and mail, or FAX, it in to the office; not enable on-line ordering.



On the subject of abuses of our electronic mail system, Paul mentioned that filters have been put in place to screen out some of the inappropriate material that has found its way onto the *amsat.bb* facility. He said that additional filters will be considered when they become available. These might take care of things such as "subscribe" and "unsubscribe" messages. Bill expressed the need to restrict upload access to the lists such as ANS and KEPS to certain prescribed individuals. Paul agreed, and said that he would institute such a policy.

Bill asked Paul about the proposal to provide *Real Audio* distribution of the Houston AMSAT Net. Paul agreed to look into the cost and other implications of this. Andy promised to find additional information from the Houston people.

Keith asked if statistics are available on people using the AMSAT Web site. Paul said that he thought it has been running around a couple of hundred per day. He promised to provide more information for the Board once he returns from vacation. Tom asked about some of the new software available to enable better cross-referencing of articles etc. Paul promised to look into this also.

Everyone thanked Paul for taking time to participate so early in the morning (7:00 AM West Coast Time) just before he was to leave on a flight.

Journal Editor Russ Tillman, who was then brought in by telephone, was thanked by the Board for his excellent work in keeping the Journal's standards high and its publication on time.

Especially evident has been the careful planning that precedes each issue. Russ acknowledged the help of Associate Editors Ron Long, Andy Reynolds, Buzz Gorsky and Bill Hook in achieving these goals. He was notified that the Board chose to not attempt electronic distribution of the Journal at the present

time. Russ was told of Ray Soifer's suggestion for an order form that could be bound into every issue of the Journal and that Martha is investigating this.

Noting that AMSAT was the first major Amateur Radio organization to have an electronic mail facility (*amsat.org*) as well as the first to have a Web site, Tom Clark recommended that AMSAT continue to maintain this technical leadership by moving toward electronic production of the Journal. He suggested several new software products that make publications more *electronically friendly*, including features to expedite archiving, topic searching and even transmitting the final copy to the printing plant. Russ Tillman said that he will look into these products. Russ was also asked to provide more details on the possibility of holding the 1998 AMSAT Annual Meeting and Space Symposium in Vicksburg, Mississippi. (See Section VI below.)

#### IV. AMSAT Nets

The Houston AMSAT group has proposed that their net be put on the Web site using the *RealAudio* technique. Paul noting that the software, licensing and installation costs for transmission may amount to several thousand dollars, Andy was asked to find out, from his Houston contacts whatever he can, relative to the amount of effort required and what the costs might be. In addition to the possibility of net retransmissions, Tom Clark suggested that there are occasions such as demonstrations where an audio component would be useful for the Web page. Paul was thanked for his work on *amsat-bb* and the Web page and wished a good trip.

#### V. Field Operations

Barry Baines, who was brought in by telephone, described the situation with respect to exhibit areas, and their cost, available at the ARRL National Convention in Peoria IL September 13-15. He said

that booth space is being handled by a commercial company and that the prices for a booth in the commercial area are rather high. It was decided that we do not need a large fancy booth, but one where we can demonstrate software and possibly run a video tape and distribute various books and other items. It was also concluded that we also should participate in the forums. Keith Baker agreed to lead the AMSAT team at this event. Other volunteers will also be there to help set up a booth and present forums for beginners and on PSD.

It was suggested that for planning purposes Barry should prepare a calendar listing those future hamfests, conventions, etc. in which AMSAT participation might be desirable, and then try to match these with available Area Coordinators.

Keith suggested that Barry ask, in the next *Field Ops Newsletter*, for information on various AMSAT nets around the country. This can then be published in the AMSAT Net Directory.

Barry reported that there are now 116 Area Coordinators of which approximately 75% can be contacted by e-mail. They periodically receive a Field Ops Newsletter to keep current on AMSAT affairs. New AMSAT members will receive a welcome letter, a list of resources including the AMSAT nets and a directory of the Area Coordinators. Tom noted that the Web site should carry a mechanism by which members may request from the AMSAT office a list of nets or the name of the nearest area coordinator. Barry applauded the work done by volunteers at the AMSAT booth at the Dayton Hamvention. Bill Tynan then expressed the Board's appreciation for Barry's excellent work as VP for Field Operations and for his fine job of coordinating the Dayton booth.

#### VI. Annual Meeting

Heather Johnson, who joined the meeting via telephone, reported that plans for the 1996 Annual Meeting and Space Symposium to be held November 8-10, 1996 in Tucson, Arizona are well underway. Seventeen papers have been delivered or promised so far and more are expected. Commercial displays, poster presentations, a demonstration satellite station and symposia on several technical levels are being scheduled. A Prize Award Chairman is still being sought. [This position was filled subsequent to the Board meeting.]

Keith informed Heather and the Board that an Amateur Radio Industry Working Group meeting is being planned just prior to the AMSAT meeting. Heather listed the attractions offered by the Tucson area including a Sunday field trip by bus to the Kitt Peak radio and optical astronomy observatories, possibly including a picnic at the site. Some discussion ensued as to how to handle the Board meeting as most of the Board members will want to go to Kitt Peak. Bill Tynan speculated that the Board meeting might begin Sunday evening as soon as everyone returns from Kitt Peak and continue for most, or all, of Monday. [This approach has since been confirmed.]

Heather was thanked for her hard work as Meeting Chairperson and she was asked to extend the Board's thanks to Larry Brown and the other volunteers she has enlisted to assist her. Bill expressed the utmost confidence in her as the Chairperson for this event.

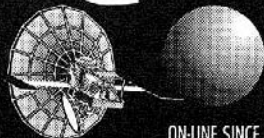
Bill announced that a preliminary proposal has been received concerning holding the 1998 AMSAT Annual Meeting in Vicksburg, Mississippi. The immediate concern was to be assured that the burden of planning and hosting the meeting would not fall predominantly upon Russ Tillman's shoulders, as he is busy enough with *The AMSAT Journal*. It was noted that Vicksburg is 50 miles from the Jackson, Mississippi airport. The area does offer recreational and historical attractions. Russ had been asked, while he was on the telephone, to obtain from the Vicksburg

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Amateur Radio Club a more detailed proposal specifying the facilities available, an estimate of costs and outlining what commitment the club could make toward supporting the event and report at the Fall Board meeting in Tucson.

## VII. "Little LEOs" and the 1997 World Radio Conference (WRC)

Bill reported on AMSAT's response to the proposal to re-allocate or share part, or all, of the amateur 2-meter and/or 70-cm bands, which has been made in one of the industry working groups convened to make recommendations for the 1997 World Radiocommunications Conference (WRC). This group is looking for space for so-called *little LEO* data satellites. He said that, early in June, AMSAT filed strongly worded letters with the various members of the working group in which the proposal was made, opposing any such action. He also said that AMSAT's position will be printed in the September/October issue of *The AMSAT Journal* (see page 24). Individual members are encouraged to file their own well-reasoned and factual comments. Art Feller described the procedure for handling such proposals in the WRC preparation process. Ray Soifer asked if it would be appropriate to ask our overseas AMSAT contacts to also file comments. Art said that it would not, as the proposal is currently before the FCC and the U.S. State Department, and is therefore an internal matter. He said that those outside the U.S. should participate through their own governments. Perry Kline agreed to represent AMSAT at a government-sponsored working group meeting to be held later this summer.

## VIII. Liaison with Academic Institutions

A protracted discussion took place on the subject of AMSAT's association with the academic community which, not surprisingly, also included the subject of future AMSAT projects. Bill Tynan noted that we have had successful associations with several universities in the past. Weber State University in Utah comes to mind. Of course, everyone is familiar with our association with Karl Meinzer's lab at the University of Marburg in Germany on the Phase 3 series of satellites and currently the Phase 3D Project. The role played by the University of Surrey in England in amateur satellites is also well known. Bill noted that there may be several potential opportunities for future collaboration, including projects at the University of Cincinnati, Stanford University and others. Tom Clark noted that at present there are several informal but notable collaborations going on with universities. As specific examples he cited a project in which he has been involved at the Technical University of Barcelona in Spain as well as one at UNAM in Mexico. Bill Tynan, while expressing satisfaction that these collaborations are going on, expressed the opinion that a more formal mechanism with which AMSAT can be identified as working with schools and universities might be of great benefit to the amateur space community. He suggested that the role of our existing Education Department could be strengthened to serve this function. Dick Daniels noted several well known members are possible candidates to perform this function. Bill also emphasized that there is a need to document the many past educational projects relating to amateur satellites that have been successfully completed. He said that this information can be very helpful in fundraising presentations. Keith Baker gave a rundown on the University of Cincinnati's project in which graduate student Chris Anderson is instrumental.

He also noted, and has passed on to Chris information that the Air Force is making some surplus Minuteman missiles available for educational satellite launches. He expressed the thought that this might be useful to that project and other university-based projects looking for launches.

It was noted that, while not all of these projects directly involve Amateur Radio, most could derive benefit by an association with AMSAT and its volunteers, and that AMSAT may benefit by identifying potential future amateur satellite builders. The need for mentoring programs involving various AMSAT volunteers was cited as a particularly important need to help these university groups acquire knowledge of satellite construction. It was recognized, however, that few AMSAT volunteers currently have the time to become closely involved with such projects.

Bill Tynan opined that university affiliations may be one way of providing future amateur satellites by AMSAT providing guidelines as to what types of spacecraft might be built, and then persuading the university groups to build them. They get the experience and we get satellites to use, he said. He noted that such collaborative efforts with academia may be the vehicle by which AMSAT can participate in the construction of various types of spacecraft, possibly including a geostationary satellite for use by amateurs. The other approach is to do it the same way in which AMSAT-NA has approached its part of the Phase 3D effort - by raising money and doing the job ourselves. Although he expressed his distaste for the idea, he noted that there is also the alternative of us depending on other organizations to build future amateur satellites and hope that they materialize and in a form useful to amateurs. Dick Daniels expressed the opinion that it is unrealistic for us to even think about anything other than relatively simple small satellites of the MICROSAT type, no matter which way we approach it. He cited their advantages as being their small size and the possibility of completing a project in 2-3 years.

Tom Clark described some of the limitations imposed upon university-sponsored satellite projects. He offered the opinion that communication projects involving balloon or remotely-controlled, solar

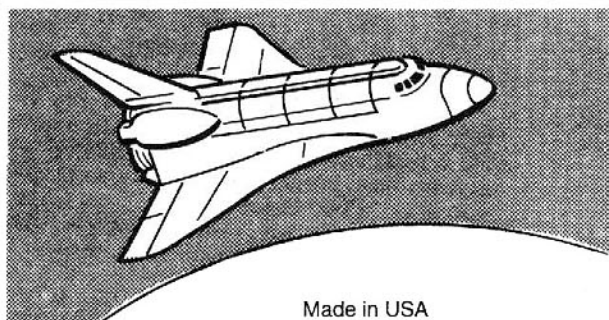
powered aircraft might have great appeal to both university professors and radio amateurs. He noted that balloon launches seem to generate almost as much excitement as do satellite launches. Bill asked if it isn't our responsibility to at least try to provide space communication facilities for radio amateurs worldwide. If we don't do it, who will?, he wondered. He further noted that it is only AMSAT groups around the world that are presently doing anything to meet this need. Keith made the point that the Phase 3D design could form the basis for any new large satellites contemplated.

There was no succinct decision reached as to how to best form cooperative arrangements with the academic community or what course AMSAT should follow after completion of Phase 3D.

## IX. Recommendations to the Future of the Amateur Service Committee (FASC)

Bill Tynan stated that the IARU has formed a committee to address several potential changes to the international Amateur Service and the Amateur Satellite Service regulations which are to be addressed at the 1999 WRC. For example, one of these is the question of whether or not nations should require a Morse Code examination for operation below 30 MHz. He said that this committee is called the Future of the Amateur Service Committee (FASC). As a preliminary step, the FASC circulated a Discussion Paper, which was sent to him for AMSAT, and for which comments are needed by June 30, 1996. On receiving this paper Bill asked Ray Soifer to lead in the preparation of an AMSAT position for presentation to the Board before forwarding it to IARU. He said that it is the review, and hopefully approval, of the draft that mainly prompted this board meeting at this particular time. Ray Soifer then led the discussion, describing the make-up, mission and schedule of the FASC. He said that the committee is to prepare [continued on page 25]

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## AMSAT-NA's Response to Little LEOs and the 1997 World Radio Conference

I write as President of the Radio Amateur Satellite Corporation (AMSAT). It has come to our attention that a major threat to Amateur Radio spectrum has been mounted. We understand that an industry working group (IWG-2A which you chair) is preparing draft U.S. proposals for the 1997 World Radiocommunication Conference, and that this group has before it a list of "candidate bands" for commercial low-earth orbit mobile satellites ("little LEOs") that includes a suggestion for the use of the 144 - 148 and 420 - 450 MHz bands for these satellites. We further understand that when the list of candidate bands was submitted by little LEO industry representatives at a meeting of IWG-2A on May 7, ARRL Technical Relations Manager Paul Rinaldo objected to the inclusion of these two bands. He was reportedly informed that such objections must be submitted in writing. Subsequently, ARRL invited the amateur community to submit comments with regard to this issue. Accordingly, AMSAT, while not a member of IWG-2A, desires to make several points in support of not considering the use of these two bands by little LEOs, either on an exclusive or shared basis.

The Radio Amateur Satellite Corporation (AMSAT), a not-for-profit District of Columbia corporation established in 1969, is the principal membership organization of the amateur-satellite community in North America with a current membership of over 7,500 in the U.S. and 76 other countries. Together with over 30 of our affiliated organizations throughout the world, we have constructed, launched and operated over two dozen satellites to date in the Amateur Satellite Service, of which sixteen are presently in operation. These currently operational spacecraft include high-altitude, Molniya-type orbit transponder satellites capable of sustaining two-way communication over terrestrial paths well in excess of 10,000 miles (AMSAT-OSCAR 10 and AMSAT-OSCAR 13), numerous low-earth-orbit (LEO) digital store-and-forward packet radio satellites (the basis for the NVNG frequency allocation being sought), scientific and educational payload satellites, LEO analog transponder satellites, and several spacecraft featuring combinations of these types of payloads.

Additional satellites for the Amateur Satellite service are planned or are presently under construction by AMSAT and its affiliate organizations in Argentina, Australia, Chile, Finland, Germany, Israel, Italy, Japan, Mexico, Russia and the United Kingdom, among others. Many of these groups are associated with universities or have access to government or industry facilities in their countries. Indeed, owing to the worldwide and cooperative nature of Amateur Radio, the construction of satellites for the Amateur Satellite Service has emerged as a principal means of technology transfer to developing countries. One organization, Surrey Satellite Technologies Ltd., associated with the University of Surrey in the United Kingdom, has built or aided in the construction of eight such satellites, with more on the way.

AMSAT itself is currently working with amateur satellite construction groups in more than a dozen countries to build the fourth and most advanced in a series of elliptical orbit amateur satellites called "Phase 3D." The next ten to twenty years is certain to see a further proliferation of this highly beneficial activity, provided that suitable spectrum is maintained for its use.

By including 144 - 148 MHz (the 2-meter band) and 420 - 450 MHz (the 70 cm band) as candidates for either reallocation or sharing, the commercial little LEO interests would be tearing the heart out of Amateur Radio. Not only is the 2-meter band the common meeting place for virtually all licensed amateurs in this country and throughout the world, it is vital to the future of amateur satellites. Of the sixteen amateur satellites currently operating, all use this band in some way - either for uplinks, downlinks, telemetry or telecommand. The Phase 3D spacecraft, now under construction, will include both uplinks and downlinks in the band. Because of antenna pattern and spacecraft orientation considerations, 2-meters is absolutely vital as a source of telemetry during rocket motor firings. The 2-meter band also figures in all the known amateur satellites under construction in various parts of the world.

The situation with respect to the 70-cm band is almost as crucial. Next to the 2-meter band it is the most popular band for terrestrial FM repeater operation in the U.S. and many other countries. It also figures prominently in amateur satellites, being used on 12 of the 16 satellites currently operating. It will also represent a mainstay on Phase 3D as both an uplink and a downlink. As is the case with the 2-meter band, the 70-cm band will be used in most of the new amateur satellites now under construction around the world.

There is another factor, unrelated to Amateur Radio, that makes the 144 - 148 MHz band particularly unsuitable for use by commercial little LEO satellites. In many countries, particularly in the Far East, the band is very crowded with non-amateur illegal commercial and personal operation. This fact has been cited by licensed radio amateurs operating amateur stations on-board both the U.S. Space Shuttle and the Russian space station, MIR, while flying over these areas. In addition, many in Europe, have noted Spanish taxicab communications coming through AMRAD-OSCAR 27, an Amateur Radio transponder, installed on the Interferometrics EYESAT satellite, which normally receives on 145.850 MHz and downlinks on 436.8 MHz. This is symptomatic of the fact that the band is illegally used even in European countries. There have even been recent reports of such illegal operation on the 144 - 148 MHz band by hunters here in the U.S. This illegal use can be attributed to the fact that the amateur market has provided a source of inexpensive high performance, portable equipment. This situation is bad for amateurs, but might well be disastrous for commercial traffic through low Earth orbiting satellites. It probably won't be long before 420 - 450 MHz is also widely used for such illegal operation, as equipment for that band is just as readily available at prices comparable to those for 144 MHz equipment. Were these bands to be reallocated to little LEOs on an exclusive basis, such illegal usage would not only remain, but may well increase as equipment formerly used by licensed amateurs eventually finds its way into the marketplace.

In summary, both of these bands are heavily used by hundreds of thousands of amateurs around the world for various purposes, including amateur satellites. They are also used illegally by an unknown, but large, number of people in many countries. Therefore, AMSAT believes that these considerations make these two bands particularly unsuitable for consideration as commercial little LEO allocations, either on an exclusive or shared basis.

Furthermore, it is especially ironic, and unfair, that these amateur frequencies would even be considered for reallocation to a commercial LEO satellite service, as it was the Amateur Radio satellite community in general, and AMSAT in particular, working in these same bands, which pioneered and first demonstrated the feasibility of LEO satellite technology for the very kind of message services now envisioned by these commercial interests. In short, it was AMSAT volunteers who invented many of the technologies these commercial interests now seek to exploit!

AMSAT believes that re-allocating these bands, even on a shared basis, to the very commercial industry that amateurs helped spawn in the crucible of these bands would establish a most self-defeating precedent. To do so, would send a clear message to amateur experimenters that the new technology they perfect today will eventually come back to haunt them in the loss of that same radio spectrum used to develop it. AMSAT can think of no greater disincentive to the advancement of the state of the radio art for both amateur and commercial interests alike.

In summary, AMSAT strongly opposes the proposals put forth in Industry Working Group-2A that suggest the use of 144-148 MHz and 420-450 MHz as suitable "candidate bands" for current or future commercial low-earth orbit satellites. Not only are these frequencies already in daily use by hundreds of thousands of licensed amateurs worldwide, they are also in daily illegal, and totally uncontrolled use, in a number of countries throughout the world. It would logically appear the use of these frequencies for commercial little LEO satellites, with their reliability requirements, would be most unappealing, if not impossible. In addition, we strongly believe that re-allocation of these frequencies, away from the Amateur Service, or requiring the Amateur Service to share them with little LEO operators, the very commercial industry which amateurs helped create, would establish a powerful disincentive for radio amateurs to continue their proven record of experimentation and technical innovation with new communication techniques for generations yet unborn.

AMSAT would be pleased to provide further information upon request. You may contact me via phone, fax, E-mail or U.S. Mail.

Respectfully,  
William A. Tynan W3XO

CF: AMSAT BoD

ARRL, D. Sumner

ARRL, P. Rinaldo



a position paper to be submitted to the IARU in preparation for the 1999 WRC.

All Board members concurred with the principle of AMSAT filing recommendations dealing only with the Amateur Satellite Service, and that there was no need for us to address other issues such as the Morse issue. Ray Soifer then presented the draft document which he, with the help of several other Board members, had prepared for approval by the full Board. He summarized its main points as follows:

- Specifically allow telecommand stations to encrypt commands to conceal meaning.
- Define the rules with respect to third party traffic to allow the transmission of scientific data and make provision such that the data need not be specifically related to radio techniques. The present requirement that all amateur transmissions be solely with a personal aim and without pecuniary interest would be retained.
- Confirm our interpretation that the present plain language requirements permit various types of data encoding as long as the data encoding is made public.
- Continue the Amateur Satellite Service as a service separate from the Amateur Service.
- Delete the words *on Earth satellites* from the definition of the Amateur Satellite Service so as to include stations aboard rockets, space probes and other such applications beyond the Earth's atmosphere.

Both Art Feller and Frank Bauer expressed some concern with the draft. Frank wanted to modify the language that exists in the current rules with respect to third party traffic, specifically to aid SAREX contacts with overseas school groups. Art was concerned with much of the thrust of the document, feeling that some of the proposed changes would be undesirable for Amateur Radio and represent too great a change from existing rules. He was particularly concerned that the proposed changes might allow communications in the amateur bands which could be accommodated on other allocations and should not be allowed in the amateur bands. He feared that such changes could eventually work against maintaining amateur allocations. In particular, he disagreed with the proposal to remove the word "radio" from type of technical data traffic that can be carried on amateur frequencies, opening them up to the transmission of any type of scientific data. Bill Tynan, while mindful of Art's past association with the FCC and his knowledge of allocation matters, expressed the view that Amateur Radio might improve its standing at allocation conferences if we can show that it is aiding scientific research leading to greater knowledge. He noted that the current rules make it difficult to do this, unless the scientific data is somehow related to radio. He cited as an example a proposed university satellite project to conduct a biological experiment, in which it was suggested that the data be telemetered on amateur frequencies. He said that he had told the group that their proposal did not meet the currently understood amateur or amateur satellite rules, since the resulting data had nothing to do with "radio" technology. Art's strong feeling was that this interpretation is correct and that such use of amateur frequencies should not be allowed.

Tom suggested that our document make it clear that what we are saying in response to the FASC paper are recommendations and that this be stated prominently at the beginning of our document, possibly in a cover letter. It was also proposed that we are aware that the recommendations we are making should be carefully studied by the FASC, prior to making recommendations to the IARU. Tom also

stated that he believes that the guidelines this Board considered several years ago are adequate to define the kinds of projects that are appropriate as amateur satellites. He summarized these as follows:

- Data formats must be made public.
- Proper notifications must be made.
- Significant involvement by licensed radio amateurs.
- Not for profit.

He pointed out that nowhere in these guidelines are the kinds of data that can be transmitted mentioned.

The consensus was that the general concept embodied in these four points reflect the recommendations we are trying to convey to the FASC, but that the current international rules say otherwise. Therefore we concluded that we would recommend that appropriate rule changes be sought at the 1999 WRC. Accordingly, Board members approved the general thrust of the document, as presented by Ray, with appropriate editorial changes made to accommodate Frank's and Tom's points. Ray and several others huddled to produce the final version.

#### X. Shuttle Amateur Radio Experiment (SAREX)

Frank Bauer reported on relevant developments in the manned space program. He said that astronaut hams on the current STS-78 (Columbia) flight had thus far contacted 11 school groups with resultant favorable publicity for Amateur Radio. He also said that the SAREX Working Group, on which he is the AMSAT representative, has decided that Amateur Radio activity on future Shuttle missions will mainly involve those flights of longer duration. SAREX flights in 1997 are planned for March, July and October and all will use FM voice and packet. An important issue to be resolved soon is the need to establish an improved International Third Party Agreement between Russia, the U.S.A. and other countries that will aid in fulfilling the educational and personal communications goals of the SAREX program. The SAREX team is actively working with Russia and our other international partners in an attempt to get a permanent waiver of third party traffic restrictions with regard to manned space vehicles.

The first phase of the International Space Station (ISS) mission will begin soon with the MIR docking flight of STS-79 (Atlantis) planned for July 31. Frank noted that every astronaut scheduled to fly on MIR has already qualified for an Amateur Radio license. Frank further stated that, as planning proceeds for an Amateur Radio presence on the ISS the acronym SAREX will be redefined to mean Space Amateur Radio EXperiment. Ham radio equipment on board the ISS will need to be simple to operate and will require the use of space-rated components. It was suggested that attendees at the Amateur Radio Industry Meeting held just prior to the AMSAT Annual Meeting be informed of the need for space-worthiness and other requirements for the Amateur Radio flight hardware planned for the ISS. This equipment will include specialized antennas, FM 2-meter and 70-cm handheld transceivers, commercial multiband, multimode transceivers for 15-meters through 1.2 GHz, TNCs for 1200 and 9600 baud packet, SSTV/JPEG and ATV. Some of this equipment may be tested on STS-83. Tom Clark speculated about what computer resources might be on board to work with this equipment to provide, e.g., a continuous Internet connection, IP routings and an improved packet robot? AMSAT will likely be given the responsibility of providing some of the power system hardware required to operate the Amateur Radio equipment on the ISS.

Frank Bauer also stated that some 2-meter frequency changes are planned for the SAREX program as the ISS becomes a reality. He will present an update on SAREX and the ISS at the AMSAT-UK Colloquium to be held in Surrey, England July 25-28, 1996. On November 4-6, 1996, ARRL, AMSAT and NASA will host a meeting of representatives from Amateur Radio organizations from the ISS Alpha Partners countries in Houston TX. Frank noted that expanding SAREX participation in the international arena will require increased financial support from AMSAT.

#### XI. Phase 3D Progress Report

Keith Baker said that he and Dick Jansson will travel to Marburg, Germany to discuss the impact of the Ariane 501 vehicle failure on the P3D flight schedule. It was noted that our SBS for the Ariane 5 is also compatible with the Ariane 4 vehicle by the use of an adapter plate. Because of the slippage of the P3D launch, dates for the testing of the SBS, vibration and thermal vacuum tests will be changed. [ANS bulletins, and other news sources, which have come out since the meeting state that Phase 3D will fly on Ariane 502 sometime in the first half of 1997.]

Keith then provided the BoD with a detailed tabulation of AMSAT-NA's past and projected P3D expenses and income as estimated to a projected launch date in April 1997. He said that the total P3D expense to AMSAT-NA is projected to be \$1,730,739. While this amount is orders of magnitude greater than that spent for any previous AMSAT project, he noted that it is similar to the original estimate. Because AMSAT-NA's projected donations for P3D are only \$1,556,086, he said it will thus be necessary for us to embark upon a P3D Launch Campaign to raise approximately \$200k to put the satellite in orbit. Keith revealed that the present cost for operating the P3D lab at Orlando is approximately \$22k per month. It should be noted, he concluded, that these figures do not include the impressive P3D expenses and receipts encountered by AMSAT organizations in other countries, notably AMSAT-DL in Germany and AMSAT-UK. He anticipated obtaining an itemization of AMSAT-DL's expenses and income for P3D during the upcoming trip. With regard to the progress made toward completing P3D, Keith said that the 400 Newton Liquid Motor and the Main Battery have arrived in Marburg, but there has been a problem in shipping the batteries because they are now listed as hazardous material by air cargo carriers. All the wiring harnesses have now been installed in the spacecraft.

Progress and problems with the P3D primary and contingency GPS receivers were discussed. Frank Bauer mentioned the possibilities for obtaining back-up receivers. Bill Tynan expressed concern that the software for the GPS may not be appropriate for the receivers to be used. Frank suggested that it should be possible to develop software compatible with a variety of receivers.

Stacey Mills, who had joined the meeting by telephone, summarized the mid-May Command Team Seminar held in Marburg. He said that the Command Team concentrated on problems associated with the projected Phase 3D orbit and the command-related spacecraft systems. Analysis of the final orbital parameters indicate that after 7-10 years the perigee will slowly increase and the orbit will become more circular. While this is preferable to the situation facing AO-13, it results in magnetotorquing eventually becoming ineffective to remove energy from the momentum wheels. This means that command stations will need to exercise precise control to maintain the spacecraft's attitude. The Arcjet motor is expected to have a useful lifetime of 4-10 years and after that additional procedures will be required to maintain attitude. It will be necessary to have as much telemetry as possible available. Stacey indicated that



the P3D telemetry system is quite complex and the software requirements will differ from those used for AO-13.

The primary concern expressed was the need to complete development of the sensors needed to stabilize the despun spacecraft.

Stacey also noted that the auxiliary battery flying on AO-13 was never used and, as a result, appears to have lost capacity over the years. Because the auxiliary battery on P3D will be called upon during Arcjet burns, a system has been incorporated to keep it in a fully charged state. On the topic of the reentry of AO-13, the latest prediction was for December 8, 1996 entering in the dark over the continental U.S. Transponder failure may occur during the third week in November, possibly during the AMSAT Annual Meeting. A contest has been proposed to recognize those individuals reading its final telemetry frame. [A report of the Command Station meeting appeared in the July/August 1996 issue of *The AMSAT Journal*.]

## **XII. AMSAT-NA Position Concerning the Proposed P5A (Mars) Mission**

Bill Tynan reported that in February 1996 Karl Meinzer brought before the P3D Program Council a proposal to build a spacecraft (P5A) intended to orbit Mars and possibly be used to relay scientific data from probes left on the surface of that planet by other missions. This spacecraft would use some of the technology developed for P3D and would, apparently, be funded by non-amateur sources. P5A would not carry an Amateur Radio transponder but its telemetry, supposedly on amateur frequencies, might be of interest to those hams who wish to equip themselves to receive its very weak signals in the 2-10 GHz range.

While no action was taken by the Board, the consensus of the members present was that Keith and Dick should attend an upcoming P5A meeting, mostly because they would already be in Europe; and get more information on what is being proposed, both technically and in terms of financing and management. Once more is known, the Board might be in a position to evaluate possible AMSAT-NA participation in the project if it is requested. [Results of the P5A Meeting are contained in the below report written by Keith and Dick.]

## **XIII. AMSAT-NA Position with Respect to Synthetic Aperture Radar Satellite (SARSat) Operation in the 70-cm Band**

Bill Tynan said that the ARRL has asked for AMSAT's assistance in writing a response to a proposal by NASA/JPL to seek a change in the Table of Allocations to permit operation of a Synthetic Aperture Radar Satellite (SARSat) around 435 MHz. Apparently, this frequency is well suited to soil penetrating radar studies using aircraft or satellites. Bill asked Perry Klein, as VP for Government Affairs, to provide technical support to the League in framing their opposition to this matter. Perry then asked for assistance in providing a technical analysis of the impact of the proposed activity on Amateur Radio. Bill suggested that he consult with Paul Rinaldo and Chris Imlay of ARRL, who should have more facts about the proposed program. Following that, additional help can be sought as needed.

## **XIV. Review of AMSAT's Position with Respect to the Proposed Rulemaking for Spread Spectrum (SS) Operation**

Bill Tynan summarized AMSAT's response to the ARRL's petition concerning a rulemaking proposal to ease certain restrictions for spread spectrum (SS) operation by amateurs on all frequencies above 420 MHz. Bill said that the short notice we had, plus a tight travel schedule, made it difficult to prepare our response as carefully as we otherwise would, and to consult with others who might provide valuable inputs. This also forced us to participate in the form of reply comments rather than the regular comments route. He said that the comments we did file supported proposed reductions of current restrictions on SS operation, but expressed the concern that if it is approved as proposed, it might represent a significant source of interference to the amateur weak signal operation and satellite downlinks. Accordingly, AMSAT's comments suggested that SS be restricted to certain parts of the microwave spectrum now considered under-used. Tom Clark said that his calculations indicate that there is some likelihood of interference to extremely weak signal work such as EME and possibly some terrestrial weak signal operation, but because satellite downlinks are power-sharing limited and not signal-to-noise limited, he believes they would be relatively unaffected by sharing with SS. He also noted that, in spite of the fact that the present STA permitting SS experimentation has been in effect for about ten years, activity has been slow in getting started. He commented that amateurs do not presently have the equipment to do the practical demonstrations which some feel necessary to prove or disprove the practicality of overlaying SS signals on existing amateur operations.

Tom also expressed concern that AMSAT may have created the impression that, in objecting to any SS activity below 450 MHz, we are thus opposing new technologies for use by amateurs. He also stated that SS techniques may offer much to improve reception of weak signals from satellites and that flexible SS rules could be important to Amateur Radio in the future.

Despite the fact that there was disagreement among some of the Board members, as to the role SS should play and how it should be introduced into Amateur Radio, there was a consensus that further dialog should be attempted in order to develop a position that both SS advocates and others who fear its impact, can agree on. This can then be presented to FCC as a common position. Art Feller stressed the importance of letting FCC officials know of this effort so they won't go to rulemaking beforehand. Once that happens, he cautioned, all contacts with FCC are banned except for formal comments. Bill Tynan said that he would attempt to start the process at the Central States Conference to be held at the end of July. He suggested the need for *council* consisting of representatives from the various weak signal groups around the country - noting that weak signal operators no longer have the voice they once did when the VUAC was in existence. Questions of what bands are appropriate for the introduction of SS, how SS stations should identify themselves and what different techniques are available for generating and receiving SS signals were discussed at some length. Art Feller recommended publication of the progress being made in developing satisfactory technical standards and to have a SS forum at the AMSAT Annual Meeting. Tom Clark suggested that some AMSAT people might discuss these issues with representatives of TAPR at the Digital Conference to be held in Seattle in September.

## **XX. Adjournment**

Prior to concluding the meeting, a motion was made by Tom Clark to accept the Recommendations to the FASC as presented by Ray Soifer and edited at this meeting (see Section IX above and page 27 of this issue). Keith Baker seconded the motion and it was passed by unanimous vote. Ray Soifer took the action to put the approved document in final form and submit it to the FASC. [This was done the day following the Board meeting, with copies of the final document posted to all directors via E-Mail.]

The BoD meeting was adjourned at 9:33 pm. ■

## **Mars Mission Proposed Keith Baker, KB1SF & Dick Jansson WD4FAB**

During a European trip dealing with important Phase 3D matters, we had the opportunity to sit in on a meeting called by Karl Meinzer to present his plan for a spacecraft to go to Mars. The following is a brief summary of that meeting:

The proposed Mars mission would use a Phase 3-D-like spaceframe carrying primarily scientific payloads. The next best time for launch of such a spacecraft is in the year 2001. Initial plans call for the spacecraft to enter an elliptical orbit around Mars after an 8.5 month transit from Earth orbit. Payloads might include such activities as communications relay of data from probes on the Martian surface back to Earth, and/or from various onboard camera or spectrometer experiments to probe the Martian surface or atmospheric environment.

It is anticipated that funding for such a project would come primarily from German government and/or other educational sources from within Europe. No AMSAT-NA organizational participation was sought nor offered, but it was anticipated that specific AMSAT-NA members might be asked to provide help on the Project. It was stated that any such individuals would be paid for their time and effort in support of the Project from Project funds.

As a result of the meeting, it now appears that a P3-D-like spaceframe, with minor modification, does have the necessary propellant and electrical capacity to travel to Mars and successfully enter Martian orbit. However, it is anticipated that one of the greatest challenges of such a mission will be improving the needed communications link capability between Mars and Earth at the proposed X and S band operating frequencies. Tradeoff studies are now ongoing to address these and other issues that embarking on such a mission would pose. ■

# Comments on FASC Discussion Paper

## by Radio Amateur Satellite Corporation, Washington, DC

The Radio Amateur Satellite Corporation (AMSAT-NA), with approximately 7,000 members, is the world's largest organization of radio amateurs participating in the Amateur Satellite Service, as well as the principal membership organization of such amateurs in North America. AMSAT-NA thanks FASC for the very thoughtful and professional way in which its discussion paper was prepared, and the invitation to offer comments. Accordingly, the following suggestions are offered for your consideration.

In this discussion, paragraph numbers refer to those in the FASC Discussion Paper, while those prefixed with the letter "S" refer to the interim numbering in the simplified radio regulations as adopted at WRC-95.

Paragraphs 6.1-6.5 discuss the present definition of the Amateur Service. S1.56. FASC points out that this has remained essentially unchanged since 1927 and it is their conclusion that the present language is "entirely appropriate and that no change should be considered."

We do not propose any change in the key phrase, "solely with a personal aim and without pecuniary interest," which we consider entirely appropriate as does FASC. However, in FASC's extensive discussion of S1.56 one phrase, curiously enough, was passed over without comment — "interested in radio technique." For reasons which will be more apparent following our discussion of paragraphs 7.1-7.6, we believe that updating this phrase may prove advantageous.

In point of fact, the "self-training, intercommunication and technical investigations" carried on over the air by today's radio amateurs involve interests that are far broader than the words "radio technique" would suggest — indeed, so broad that attempting to characterize them in the ITU Regulations may now well be inappropriate. Our suggestion is simply to amend S1.56 by dropping these four words entirely; the new language would thus read:

- S1.56. Amateur Service: A radiocommunication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, by duly authorized persons solely with a personal aim and without pecuniary interest.

We recognize that this suggestion is likely to be controversial. Our purpose in raising this issue at this early stage of IARU's decision process is to stimulate a full discussion of its potential consequences for amateur radio, pro or con, over the next three years. Because of its specific importance to the amateur-satellite service, we request that FASC continue to involve us in this discussion as it takes place.

AMSAT-NA has several issues relating to the nature and content of amateur transmissions, discussed by FASC at 7.1-7.6 and by ITU at S25.2-S25.4.

With respect to the use of "plain language" (7.2 and S25.2), national administrations from whose countries telecommand stations operate have frequently authorized exceptions for such operations, e.g., the following regulation and associated definition from the US Code of Federal Regulations (CFR):

- "A telecommand station may transmit special codes intended to obscure the meaning of telecommand messages to the station in space operation." [47 CFR Sec. 97.211(b)]
- "Telecommand station: An amateur station that transmits communications to initiate, modify or terminate functions of a space station." [47 CFR Sec. 97.3(a)(37)]

AMSAT-NA considers the ability to transmit enciphered telecommand messages to be absolutely essential to the fulfillment of the requirements of S22.1 and S25.11. Indeed, the telecommand of amateur space stations has been done in this way since the first remotely-commanded amateur spacecraft, *Australis-OSCAR 5* in 1970. Further, it is frequently the case that the space station is licensed by one country while one or more of its authorized telecommand stations are licensed in other countries; AMSAT-OSCAR 13, for example, is licensed in Germany and telecommanded by authorized stations not only in that country but also in Australia, UK and the US. Thus, it is often the case telecommand transmissions are made "between amateur stations of different countries" (S25.2).

In view of the security concerns expressed by many emerging nations, we recognize that amending the "plain language" requirement itself may be difficult to accomplish. Rather, it may be more feasible to secure the adoption of a provision or footnote that expressly permits national administrations to authorize the use of special codes by telecommand stations, along the lines of the US regulatory language quoted above. To our knowledge, this issue has not been raised among administrations, but we are concerned that it may be at some time in the future.

A second issue with respect to "plain language" concerns the use of digital coding techniques and/or spread spectrum emissions for transmissions to and from amateur satellite stations.

AMSAT-NA believes that it must be mandatory that the codes and algorithms employed for such transmissions be widely published, to enable all amateurs worldwide to take part in the experiments involved. Furthermore, this provision should satisfy the security needs of national administrations (7.2) as well as assist amateur monitoring organizations such as the Intruder Watch.

Indeed, the use by amateurs of widely-published coding and data compression techniques, intended to facilitate communications rather than to obscure meaning, is hardly limited to transmissions to and from space. Picture files (eg. \*.GIF), compressed data files (eg. \*.ZIP) and forward error correction (FEC) are common examples. What all of these have in common is that the content of a transmission sent with them is context-dependent, i.e., a small snippet of reception conveys no information and the message can only be known after an entire transmission has been received and decoded.

We interpret the phrase "plain language," in the context of S25.2, to include any code or algorithm which has been widely published and is available to radio amateurs generally as well as to governmental monitoring agencies. If, in the opinion of FASC, this interpretation is not shared generally, then further attention must be given to this issue, as we consider it vital to continuing technical development of the amateur service and the amateur-satellite service.

We now turn to the content of amateur transmissions, discussed by FASC at 7.3 and 7.4.

While we agree entirely with FASC's suggestion, made at 7.4, that the words "for which, by reason of their unimportance, recourse to the public telecommunications service is not justified" should be dropped as being unnecessary in today's environment, that in itself may not entirely resolve a problem with which the amateur-satellite service is increasingly confronted.

As many FASC members already know, a decreasing number of amateur radio satellites today are built in basement workshops or the equivalent, and launched free of charge by friendly government agencies, as occurred frequently in the past. In 1996, the typical satellite program in our service requires the out-of-pocket expenditure of up to several million dollars, much of which must go to pay for the launch itself. This situation is expected to remain, and become even more prevalent in the future.

For financial reasons as well as those having to do with the allocation of launch opportunities, the vast majority of spacecraft presently operating in and under construction for the Amateur Satellite Service today are the products of university laboratories; indeed, IARU's own International Satellite Forum takes place each year at the most prolific of such laboratories, that of the University of Surrey in Guildford, England.

Universities have many reasons for devoting their resources to the construction and operation of amateur radio satellites, but among them is the desire to conduct scientific research outside the earth's atmosphere and transmit the results to earth by means of telemetry.

The present language of S25.2, when read in conjunction with S1.56, may pose a barrier to university-affiliated groups seeking to provide additional satellites to our service.

Consider, for example, the transmission back to earth of results from a scientific experiment on board an amateur spacecraft. Such transmissions are obviously not "of a personal character," nor, after millions of dollars have been spent to make them possible, could they be considered to be "unimportant." What they are, however, could well be encompassed by the phrase "messages of a technical nature relating to tests" (S25.2).

The issue which we wish to raise, however, arises when that phrase in S25.2 is read in the light of S1.56, which defines the amateur service as one of "technical investigations carried out by amateurs, that is, by duly authorized persons interested in radio technique." Must the "tests" referred to in S25.2 pertain to "radio technique?" (S1.56)

Many of the university-based experiments now in progress via amateur radio satellites would be hard pressed to meet so narrow a definition, and AMSAT-NA is frequently approached with proposals from other such groups that would be at least as far afield. Several of these are discussed in Note 1, below.

AMSAT-NA fully agrees with FASC that all transmissions from amateur stations, including those from space stations, should be "non commercial, non political, non religious, non entertainment and unpaid" (7.5). We ask whether a way should be found, within the ITU Regulations, to permit not-for-profit scientific research, the subject matter of which does not necessarily pertain to "radio technique," to be conducted within the Amateur Satellite Service by otherwise qualified stations and thus to facilitate the continuing supply of satellites for amateur use.



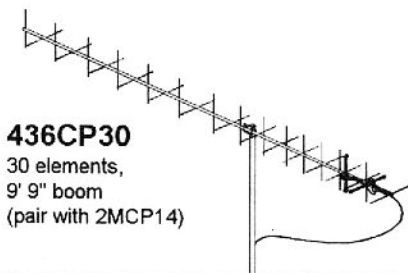
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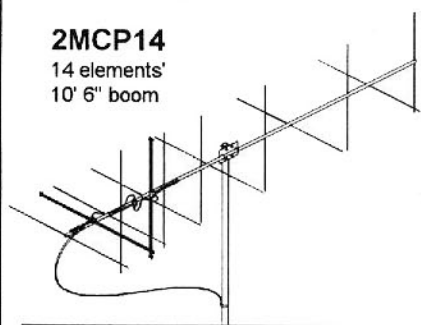
**436CP42-U/G**

42 elements,  
18' 10" tapered boom  
(pair with 2MCP22)



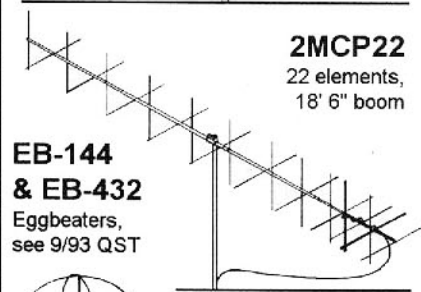
**436CP30**

30 elements,  
9' 9" boom  
(pair with 2MCP14)



**2MCP14**

14 elements'  
10' 6" boom

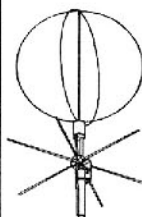


**2MCP22**

22 elements,  
18' 6" boom

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In addition to the consideration involving the providing of future amateur satellites, AMSAT-NA believes that there is another strong reason for liberalizing the ITU rules with respect to the content of amateur transmissions, as discussed above. We believe that such a change will encourage the use of the amateur service and permit the amateur-satellite service to participate in scientific research aimed at increasing mankind's knowledge in a variety of fields. This, we contend, will provide additional justification for maintaining amateur service and amateur-satellite service frequency allocations.

In this context, one can see the advantage to our service of eliminating the phrase "interested in radio technique" from S1.56, as proposed above. With this done, as well as the change to S25.2 suggested by FASC at 7.4 and our own earlier suggestion regarding telecommand stations, S25.2 (1) would read as follows:

- S25.2 (1) When transmissions between amateur stations of different countries are permitted, they shall be made in plain language [footnote] and shall be limited to messages of a technical nature relating to tests and/or to remarks of a personal character.

[Footnote: Member countries may authorize their amateur stations, when transmitting communications for the purpose of initiating, modifying or terminating functions of a space station in the Amateur Satellite Service, to use means intended to obscure the meaning of such communications.]

Read in conjunction with the amended S1.56 discussed above, this language would, in effect, permit such "tests" to pertain to any technical subject as long as the transmission is carried out by duly authorized amateurs, solely with a personal aim and without pecuniary interest. National administrations, of course, would retain the right to interpret these requirements as they see fit, in the context of the prevailing customs and practices in their own countries, as long as they do not permit amateur stations to be used for reward or for carrying messages of a business character (8.13).

It will also be noted that we are suggesting that the word "and" in S25.2 (1) be changed to "and/or." No substantive change is intended by this suggestion, which in our opinion would simply be more descriptive of the actual situation than the existing language.

Turning to international communications more generally, we agree fully with the suggestions of FASC at 7.6, 8.10, 8.11 and 11.1.

AMSAT-NA concurs with FASC in its proposed changes to the international third party restrictions in the amateur-satellite service. These restrictions have severely limited the ability of our manned space program to stimulate students' interest in the fields of communications, technology and space sciences. Many opportunities for students to converse with astronauts and cosmonauts have been missed because of existing restrictions on third party traffic. This situation will grow in importance with the planned installation of an amateur station on the International Space Station because that Station will be manned by nationals of eight primary member countries. Only two of these countries currently have a third party traffic agreement with each other.

We also suggest that the change proposed by FASC is consistent with the many international declarations promoting the free flow of information between peoples of all nations.

We turn now to Section 12, which deals specifically with the regulations defining the Amateur

Satellite Service itself and with certain requirements affecting this service.

AMSAT-NA agrees with FASC's suggestion, at 12.6, that S1.57 be amended by deleting the phrase, "on earth satellites" from the definition of the Amateur Satellite Service. In our view, no useful purpose is served by restricting amateur space stations to earth orbit. Proposals for amateur stations beyond earth orbit continue to be made from time to time; serious discussions have been held, for example, about a solar sailing experiment, payloads on the lunar surface and, most recently, an unmanned Mars probe [Note 1], all carrying amateur radio transmitters. In addition to these as-yet unrealized proposals, amateur stations have already been placed on rockets going beyond the major portion of the earth's atmosphere (hence, "space stations") but intended to return to earth rather than entering orbit. More such rocket experiments are anticipated in the near future and we see no reason why they should be discouraged by the wording of the Radio Regulations.

We also concur with FASC, at 12.9, that the Amateur Satellite Service should continue to be defined separately from the amateur service. We can see no advantage to merging the two; to quote an old American proverb, "if it ain't broke, don't fix it." Another advantage of keeping the two services separate might be to provide the flexibility of allowing some of the rule changes cited herein to be applied to one but not necessarily the other. Although AMSAT-NA believes that the provisions with respect to message content, suggested herein, should apply to both services, they might be easier to "sell" if they pertain only to the amateur-satellite service. It would also be desirable, we believe, to maintain the present distinction between the two services in the event that, in some future frequency allocation matter, a particular portion of the spectrum would be more suitable for one service than the other.

With respect to the discussion of interference and telecommand matters at 12.10-12.14, we agree with FASC that S25.11 appears redundant in view of S22.1 and S5.282, and in an ideal world should probably be deleted. On the other hand, as noted at 12.13, S25.11 adds no requirements to those already imposed by S22.1 and S5.282 and if raising the issue might be counterproductive, perhaps it would be best to leave the entire matter alone. The issue of whether or not we should seek the deletion of S25.11 should be discussed within IARU over the next two years to gain a better understanding of the political situation; either way, however, AMSAT-NA does not consider it a high-priority issue at this time.

We are very concerned, however, with upgrading the status of the Amateur Satellite Service bands above 146 MHz which are presently covered by S5.282. As noted by FASC at 12.14, this concern cannot be addressed except in the context of an allocation conference, but we wish to place the matter on IARU's agenda to be dealt with at an appropriate time. There are, in addition, other allocations matters which we would like to see brought before a future WRC and would propose a continuing dialogue with IARU with an aim of eventually bringing these about.

We look forward to continuing to work with FASC, with the IARU Satellite Adviser and IARU AMSAT Frequency Coordinator, and with IARU's regional organizations and member societies in furthering our common goal of a successful WRC-99.

Respectfully submitted,

Radio Amateur Satellite Corporation  
by William A. Tynan, W3XO, President  
June 29, 1996

Note 1: There are several instances of AMSAT-NA's having being approached on, or



actually participating in projects which might have difficulty meeting a rigorous interpretation of S25.2:

(a) One, which we felt we had to conclude was beyond the bounds of scientific data meeting the current rules, involved a satellite proposed by the University of Utah to fly a biological experiment. It was proposed to telemeter the results of this experiment on the 144 - 146 MHz amateur band because "simple, cheap readily available receivers (scanners) exist that will enable school children

worldwide to participate in obtaining the experiment's results".

(b) Another involved the initial proposal for a satellite being built by Arizona State University. One of the original stated purposes of this satellite was to obtain data on erosion of a spacecraft's surface by micrometeorites. While not appearing to have anything to do with radio technique per se, we did conclude that we could support this effort under current international regulations because the data might be useful in designing future amateur satellites.

(c) Another example concerns a proposed project for an amateur Mars probe. This is also university based, in this case a German university. Aside from the objective of providing radio amateurs throughout the world the challenge of tracking and obtaining data from a spacecraft at interplanetary distances, it has been proposed that this probe, once in orbit around Mars, could be used to relay data from scientific probes landed on the planet's surface by other, not necessarily amateur, space vehicles. ■

| Satellite Orbital Elements |                |                |                |                |                |                |                    |
|----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|--------------------|
| Ray Hoad, WA5QGD           |                |                |                |                |                |                |                    |
| Satellite                  | AO-10          | UD-11          | RS-10/11       | AO-13          | FO-20          | RS-12/13       | RS-15              |
| Catalog Number             | 14129          | 14781          | 18129          | 19216          | 20480          | 21089          | 23439              |
| Epoch Time                 | 96238.89296850 | 96241.99241019 | 96242.10424735 | 96241.93209375 | 96242.04795746 | 96242.07647531 | 96242.09358094     |
| Element Set                | 450            | 921            | 262            | 261            | 910            | 931            | 172                |
| Inclination                | 25.9885        | 97.8047        | 82.9254        | 57.1459        | 99.0241        | 82.9242        | 64.8161            |
| RA of Node                 | 192.7666       | 229.4952       | 94.6512        | 95.2606        | 253.0428       | 135.3002       | 265.182            |
| Eccentricity               | 0.6032591      | 0.001077       | 0.0011214      | 0.7438684      | 0.0540587      | 0.0031296      | 0.0159613          |
| Arg of Perigee             | 43.4713        | 215.8037       | 320.523        | 49.07          | 319.4589       | 30.5352        | 186.3198           |
| Mean Anomaly               | 350.6635       | 144.2445       | 39.5106        | 354.8698       | 36.7412        | 329.7608       | 173.5698           |
| Mean Motion                | 2.05881051     | 14.69474492    | 13.72368744    | 2.11516752     | 12.8323395     | 13.74073327    | 11.2752838         |
| Decay Rate                 | 0.00000038     | 0.00000049     | 0.00000041     | 0.00035764     | -0.00000021    | 0.00000101     | -0.00000039        |
| Epoch Rev                  | 9927           | 66834          | 46017          | 6286           | 30723          | 27904          | 6900               |
| Satellite                  | FO-29          | UD-14          | AO-16          | DO-17          | WO-18          | LO-19          | LO-22              |
| Catalog Number             | 24278          | 20437          | 20439          | 20440          | 20441          | 20442          | 21575              |
| Epoch Time                 | 96242.61067780 | 96242.10238889 | 96241.84752639 | 96242.07245242 | 96241.78399574 | 96242.12406861 | 96242.22965486     |
| Element Set                | 9              | 218            | 16             | 6              | 22             | 19             | 711                |
| Inclination                | 98.7587        | 98.5418        | 98.5563        | 98.5574        | 98.558         | 98.5604        | 98.346             |
| RA of Node                 | 317.0008       | 323.7449       | 325.8437       | 326.7393       | 326.3873       | 327.249        | 306.4232           |
| Eccentricity               | 0.0301961      | 0.0011453      | 0.0011508      | 0.0011974      | 0.0012384      | 0.001242       | 0.0008458          |
| Arg of Perigee             | 211.9862       | 352.5871       | 353.9183       | 352.3047       | 352.6188       | 351.4832       | 50.3593            |
| Mean Anomaly               | 146.3172       | 7.515          | 6.1842         | 7.7956         | 7.4809         | 8.6113         | 309.8339           |
| Mean Motion                | 13.46309076    | 14.29929248    | 14.2998244     | 14.30124362    | 14.30093844    | 14.30203253    | 14.37033631        |
| Decay Rate                 | -0.0000108     | 0              | -0.00000018    | -0.00000004    | -0.00000018    | -0.00000001    | 0.00000006         |
| Epoch Rev                  | 175            | 34447          | 34445          | 34451          | 34447          | 34454          | 26855              |
| Satellite                  | KO-23          | AO-27          | IO-26          | KO-25          | Mir            | Hubble         | Phase 3D 502 (est) |
| Catalog Number             | 22077          | 22825          | 22826          | 22828          | 16609          | 20580          | 99934              |
| Epoch Time                 | 96241.94822675 | 96242.10258403 | 96242.09334992 | 96242.12728733 | 96242.13611906 | 96242.01162401 | 96260.25523447     |
| Element Set                | 603            | 504            | 505            | 484            | 669            | 917            | 3                  |
| Inclination                | 66.0818        | 98.5775        | 98.5771        | 98.5726        | 51.6501        | 28.4671        | 60.0203            |
| RA of Node                 | 37.1179        | 316.3223       | 316.4942       | 316.5891       | 116.5491       | 110.4302       | 342.7876           |
| Eccentricity               | 0.001481       | 0.0009526      | 0.0010181      | 0.0010648      | 0.0011235      | 0.0006001      | 0.6752895          |
| Arg of Perigee             | 280.7437       | 19.8031        | 20.4912        | 7.243          | 110.354        | 214.7478       | 180.1221           |
| Mean Anomaly               | 79.1914        | 340.3517       | 339.6682       | 352.8873       | 249.8662       | 145.2713       | 179.5089           |
| Mean Motion                | 12.86297788    | 14.27701716    | 14.27811307    | 14.28149283    | 15.6182585     | 14.91086934    | 1.51063968         |
| Decay Rate                 | -0.00000037    | -0.00000034    | 0.00000023     | -0.00000042    | 0.00005256     | 0.00000361     | 0.00002            |
| Epoch Rev                  | 19016          | 15239          | 15240          | 12052          | 60140          | 14946          | 2                  |

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- |                 |             |          |
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# AMSAT Journal Telemetry

## AO-13 - Your Last Chance!

The AO-13 Command Team reports drag has not been quite as severe as initially estimated, allowing AO-13 to be moved for a final session at a favorable attitude. The duration of this orientation is unknown, but on or before November 1st, reorientation will be necessary. Re-entry is expected for the second week of December.

## AO-13 TRANSPONDER SCHEDULE

1996 Sep 01 - Nov ??

Mode-B: MA 0 to MA 40 |  
Mode-BS: MA 40 to MA 180 | Nominal Alon/Alat 170/0  
Mode-B: MA 180 to MA 256 |  
Omnis : MA 200 to MA 25 | Move to attitude 90/0, Nov ??  
Eng.Beac: MA 140 to MA 60 | 145.985 MHz

NOTE: In order to determine and adjust the attitude of AO-13, there will be occasional command station switchovers to the Mode-S beacon during times of

favorable squint angle. The mode-B transponder will be off for a few minutes at these times. Service will be restored as quickly as possible. The higher powered engineering beacon (145.985 MHz) is currently ON from MA 140 to MA 60. Eventually, this will be turned on full time for the duration of AO-13's functional existence.

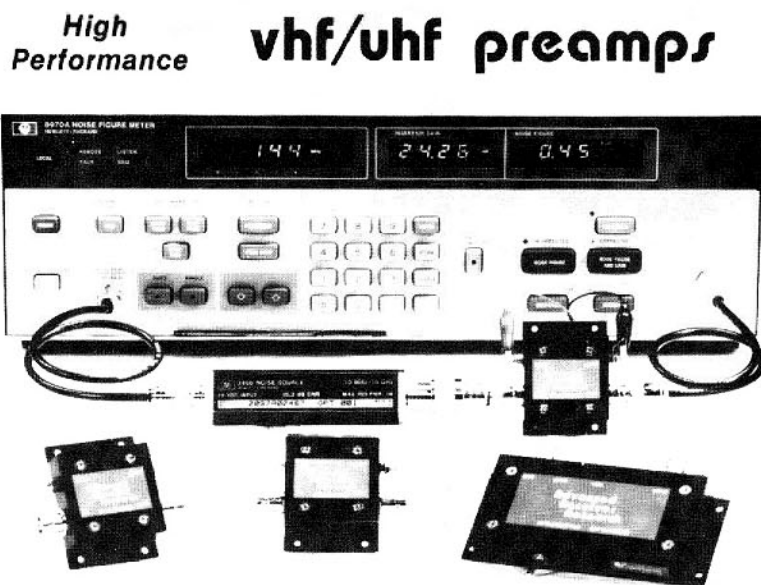
The drag effects at perigee cause the ALAT to rise slightly each orbit. The initial orientation for this period will be approximately ALON/ALAT 170/-10 with ALAT progressively rising during this time period.

The nominal ALON/ALAT for this orientation allows for much more favorable squint angles early in the orbit when AO-13 is relatively high in the northern hemisphere, without greatly affecting the currently excellent conditions for users in the southern hemisphere. This should be a very good orientation. Use and enjoy AO-13 during this final favorable attitude.

When this orientation becomes impossible to maintain, or by November 1st, AO-13 will be turned to its final attitude of ALON/ALAT 90/0. This will provide protection of the solar panels and omni-directional antenna from perigee heating and will reduce the drag associated deflection of the ALAT. From this point until the demise of the electronics AO-13 will be Mode-B only, full-time omni antenna, much as with AO-10. ■

## Horkheimer Prize 1996 Awarded To Dr. Karl Meinzer, DJ4ZC

The prestigious Horkheimer Prize has been awarded this year to AMSAT-DL President Dr. Karl Meinzer, DJ4ZC, at the Ham Radio convention at Friedrichshafen, Germany. The prize is awarded to members of an IARU amateur radio society by the Deutscher Amateur Radio Club (DARC) for *merits of amateur radio, its further development and the targets of DARC*. It is named after Rudolf Horkheimer, one of the first radio amateurs in Germany. Dr. Karl Meinzer, DJ4ZC, has been honored for his outstanding achievement in the technical fields of the amateur radio service for decades. ■



| Receive Only         | Freq. Range (MHz) | N.F. (dB) | Gain (dB) | 1 dB Comp. (dBm) | Device Type | Price    |
|----------------------|-------------------|-----------|-----------|------------------|-------------|----------|
| P28VD                | 28-30             | < 1.1     | 15        | 0                | DGFET       | \$29.95  |
| P50VD                | 50-54             | < 1.3     | 15        | 0                | DGFET       | \$29.95  |
| SP50VDG              | 50-54             | < 0.5     | 24        | + 12             | GaAsFET     | \$79.95  |
| P144VD               | 144-148           | < 1.5     | 15        | 0                | DGFET       | \$29.95  |
| P144VDA              | 144-148           | < 1.0     | 15        | 0                | DGFET       | \$37.95  |
| P144VDG              | 144-148           | < 0.5     | 24        | + 12             | GaAsFET     | \$79.95  |
| P220VD               | 220-225           | < 1.8     | 15        | 0                | DGFET       | \$29.95  |
| P220VDA              | 220-225           | < 1.2     | 15        | 0                | DGFET       | \$37.95  |
| P220VDG              | 220-225           | < 0.5     | 20        | + 12             | GaAsFET     | \$79.95  |
| P432VD               | 420-450           | < 1.8     | 15        | -20              | Bipolar     | \$32.95  |
| P432VDA              | 420-450           | < 1.1     | 17        | -20              | Bipolar     | \$49.95  |
| P432VDG              | 420-450           | < 0.5     | 16        | + 12             | GaAsFET     | \$79.95  |
| Inline (rf switched) |                   |           |           |                  |             |          |
| SP28VD               | 28-30             | < 1.2     | 15        | 0                | DGFET       | \$59.95  |
| SP50VD               | 50-54             | < 1.4     | 15        | 0                | DGFET       | \$59.95  |
| SP50VDG              | 50-54             | < 0.55    | 24        | + 12             | GaAsFET     | \$109.95 |
| SP144VD              | 144-148           | < 1.6     | 15        | 0                | DGFET       | \$59.95  |
| SP144VDA             | 144-148           | < 1.1     | 15        | 0                | DGFET       | \$67.95  |
| SP144VDG             | 144-148           | < 0.55    | 24        | + 12             | GaAsFET     | \$109.95 |
| SP220VD              | 220-225           | < 1.9     | 15        | 0                | DGFET       | \$59.95  |
| SP220VDA             | 220-225           | < 1.3     | 15        | 0                | DGFET       | \$67.95  |
| SP220VDG             | 220-225           | < 0.55    | 20        | + 12             | GaAsFET     | \$109.95 |
| SP432VD              | 420-450           | < 1.9     | 15        | -20              | Bipolar     | \$62.95  |
| SP432VDA             | 420-450           | < 1.2     | 17        | -20              | Bipolar     | \$79.95  |
| SP432VDG             | 420-450           | < 0.55    | 16        | + 12             | GaAsFET     | \$109.95 |

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